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

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

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## Distribution Advanced Answer Key

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1. Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

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

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Any other concerns or comments.

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



## Distribution Advanced CEU Training Course Assignment

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

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

### Backflow/Cross-Connection Section What is backflow? Reverse flow condition

1. Which of the following terms 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. Backflow                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above
2. Which of the following terms is a form 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. Backflow                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above
3. 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                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above
4. The principal types of mechanical backflow preventers are the reduced-pressure principle assembly, the \_\_\_\_\_, and the double check valve assembly.  
A. High hazard installations    D. Backflow  
B. Air gap                        E. Device or method  
C. Vacuum breaker              F. None of the Above
5. Which of the following terms can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both?  
A. Backflow                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above

6. Which of the following terms can have two forms-backpressure and backsiphonage?  
 A. Backflow                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
7. The basic mechanism for preventing backflow is a mechanical \_\_\_\_\_, which provides a physical barrier to backflow.  
 A. High hazard installations    D. Backflow  
 B. Air gap                        E. Device or method  
 C. Backflow preventer           F. None of the Above
8. Which of the following terms is the means or mechanism to prevent backflow?  
 A. High hazard installations    D. Backflow  
 B. Air gap                        E. Device or method  
 C. Backflow preventer           F. None of the Above
9. Which of the following terms can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?  
 A. Backflow                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
10. Which of the following terms is a form 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                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
11. 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. High hazard installations    D. Backflow  
 B. Air gap                        E. Device or method  
 C. Backflow preventer           F. None of the Above

**Types of Backflow Prevention Methods and Assemblies**

12. Which of the following terms must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?  
 A. Backflow                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
13. The type of device selected for a particular installation depends on several factors.  
 A. True                      B. False
14. When the airflow is restricted, such as the case of an air gap located near a wall, the \_\_\_\_\_ separation must be increased.  
 A. Open receiving vessel        D. Air gap  
 B. Backflow preventer           E. Air break  
 C. Barrier to backflow           F. None of the Above

15. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of an?

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

16. Which of the following terms must be at least two times the diameter of the supply pipe and not less than one inch?

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

17. According to the text, 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

18. 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. 3 inches
- D. Backflow
- E. Depends
- F. None of the Above

19. 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. High hazard installations
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

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

- A. High hazard installations
- B. Backflow preventer
- C. Barrier to backflow
- D. Low pollutional hazards
- E. High pollutional concerns
- F. None of the Above

### **Water Distribution Section - Water Distribution System Design and Valves System Elements**

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

- A. Increase water pressure
- B. Equalize
- C. Complete gridiron system
- D. Boost flow
- E. Provide a reserve pressure
- F. None of the Above

22. Valves control the flow of water in the distribution system by isolating areas for repair or by?

- A. Increase water pressure
- B. Bypasses
- C. Complete gridiron system
- D. Main line isolation
- E. Regulating system flow or pressure.
- F. None of the Above

23. According to the text, gate valves should be used in the \_\_\_\_\_ for main line isolation.

- A. Increase water pressure
- B. Distribution tree
- C. Complete gridiron system
- D. Distribution system
- E. Arterial system
- F. None of the Above

24. Distribution mains function is to carry water from the water source or treatment works to users, these are the pipelines that make up the?

- A. Increase water pressure
- B. Distribution tree
- C. Complete gridiron system
- D. Distribution system
- E. Arterial system
- F. None of the Above

25. Arterial mains are interconnected with smaller distribution mains to form a complete gridiron system and are for?

- A. Increasing water pressure
- B. Tree system
- C. Complete gridiron system
- D. Distribution mains of large size
- E. Fire protection
- F. None of the Above

26. Storage reservoirs are structures used to store water and \_\_\_\_\_ the supply or pressure in the distribution system.

- A. Increase water pressure
- B. Equalize
- C. Complete gridiron system
- D. Main line isolation
- E. Provide a reserve pressure
- F. None of the Above

27. 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. Complete gridiron system
- D. Main line isolation
- E. PRV
- F. None of the Above

28. One purpose of installing shutoff valves in water mains at various locations within the distribution system is to allow sections of the system to be \_\_\_\_\_ or to provide maintenance without significantly curtailing service over large areas.

- A. Feeders as practical
- B. Adjust the pressure
- C. Open or close the valve
- D. Curtail the service
- E. Taken out of service for repairs
- F. None of the Above

29. According to the text, at intersections of distribution mains, the number of valves required is normally one less than the number of?

- A. Ties
- B. Depends
- C. Radiating mains
- D. Throttling purposes
- E. Standardizes
- F. None of the Above

30. All buried small- and medium-sized valves should be installed in the sidewalk.

- A. True
- B. False

31. For large shutoff valves, it may be necessary to surround the valve operator or entire valve within a vault or manhole to allow?

- A. Principally
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

### Gate Valves

32. In the distribution system, gate valves are used when a straight-line flow of fluid and?

- A. Principally
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

33. In the distribution system, or on a residential job, gate valves are so-named because the part that either \_\_\_\_\_ flow through the valve acts somewhat like a gate.

- A. Fully drawn up
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

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

- A. Fully drawn up
- B. Dependable
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

35. Gate valves are not suitable for?

- A. Copper lines
- B. Dependability
- C. PRV
- D. Throttling purposes
- E. Pressure drops
- F. None of the Above

36. The control of flow is easy because of the gate valve's design, and the flow of fluid

- A. True
- B. False

### Ball Valves

37. Most ball valves require only a 180-degree turn to either completely open or close the valve.

- A. True
- B. False

38. According to the text, some ball valves are operated by planetary gears.

- A. True
- B. False

### Valve Exercising

39. Valve exercising should be done to locate inoperable due to freezing or build-up of rust or corrosion and done once per year to detect \_\_\_\_\_ and to prevent valves from becoming

- A. Malfunctioning valves
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

40. A valve inspection should include drawing valve location maps to show distances to the \_\_\_\_\_ from specific reference.

- A. Valve(s)
- B. Stoneline
- C. Monument
- D. House
- E. Telephone pole
- F. None of the Above

41. Service connections are used to \_\_\_\_\_ or other plumbing systems to the distribution system mains.

- A. Be isolated
- B. Connect individual buildings
- C. By laying out
- D. Limits the expansion
- E. Decreases in size
- F. None of the Above

### If Excessive Torque is Needed to Work the Valve

42. One cause of a valve failing to open are variations in the temperature and/or pressure of the?

- A. High pressure side
- B. Working fluid
- C. Closing torque applied
- D. Valve sealing surfaces
- E. Length of exposure
- F. None of the Above

43. Depending on the seat and wedge material, \_\_\_\_\_ and closing torque applied, thermal binding can also occur in high temperature situations.

- A. High pressure side
- B. Working fluid
- C. Closing torque applied
- D. Valve sealing surfaces
- E. Length of exposure
- F. None of the Above

44. Over-pressurization is when a valve can \_\_\_\_\_ when high pressure enters the cavity and has no way to escape.

- A. Over-pressurization
- B. Positive pressure differential
- C. Lock in the closed position
- D. Lock in the open position
- E. Break
- F. None of the Above

45. According to the text, a single direction sealing gate valve has a nameplate on the side of the valve that has a relief hole or pressure equalizer.

- A. True
- B. False

46. Tuberculation corrosion is caused by chemical changes produced by?

- A. Closed position
- B. Hard water
- C. Chemical changes
- D. Electricity or electrolysis
- E. Positive pressure differential
- F. None of the Above

47. Corrosion will increase the C-Factor and the carrying capacity in a pipe.

- A. True
- B. False

#### **Knife Gate Valve**

48. Install the Knife Gate valve so that the arrows on both sides of the body are in the direction of?

- A. Positive pressure differential
- B. Handwheel pointing up
- C. Connect individual buildings
- D. Direction of the service
- E. Bonnet
- F. None of the Above

#### **Common Rotary Valves**

49. Globe valve, a rotary valve is rare to find in most distribution systems, but can be found at treatment plants.

- A. True
- B. False

50. Most Globes have compact OS & Y type, bolted bonnet, rising stems, with renewable seat rings.

- A. True
- B. False

51. According to the text, Globe valves should usually be installed with the inlet below the bonnet.

- A. True
- B. False

52. For light throttling service, the valve may be installed so that the flow enters over the bottom of the seat and goes up through it.

- A. True
- B. False

53. The globe valve may be installed in other orientations, but any deviation from vertical is a compromise.

- A. True
- B. False

## System Layouts

### Tree System

54. Newer water systems are frequently expanded with planning and developed into a tree-like system.  
A. True      B. False
55. The Tree system consists of a single main that \_\_\_\_\_ as it leaves the source and progresses through the area originally served.  
A. Be isolated      D. Limits the expansion  
B. Connect individual buildings      E. Decreases in size  
C. By laying out      F. None of the Above
56. Smaller pipelines \_\_\_\_\_ the main and divide again, much like the trunk and branches of a tree.  
A. Branch off      D. Limit the expansion  
B. Are manifolded to      E. Decrease  
C. Connect      F. None of the Above
57. According to the text, there are several advantages gained by laying out water mains in a loop or grid, with feeder and distributor mains interconnecting at roadway intersections and other regular intervals.  
A. True      B. False

### Friction Loss

58. The damaged section can be isolated and the remainder of the system will still carry pressure, water will not be distributed if a single section fails.  
A. True      B. False
59. During periods of peak fire flow demand, there will be less impact from \_\_\_\_\_ in water mains as the velocity within any given section of main.  
A. Carrying capacity      D. Static pressure  
B. Friction loss      E. Total pressure  
C. Pressure      F. None of the Above

### Steel Pipe

60. Steel pipe is available in various diameters and in 20' or 21' lengths; its main advantage is the ability to form it into a variety of shapes.  
A. True      B. False
61. Steel pipe's advantage is that it is able withstand corrosion by both soil and water.  
A. True      B. False
62. Steel pipe is usually galvanized or dipped in coal-tar enamel and wrapped with coal-tar impregnated felt to reduce?  
A. Corrosion problems      D. Good yielding  
B. Bending      E. Confusion with other pipes  
C. Costs      F. None of the Above
63. From a health standpoint coal-tar products are undergoing scrutiny and it is recommended that the appropriate regulatory agencies be contacted prior to use of this material.  
A. True      B. False

### Asbestos Cement Pipe (ACP)

64. ACP is available in diameters from 3" to 36" and in 13' lengths.

- A. True      B. False

65. ACP main advantages are its ability to \_\_\_\_\_ and its excellent hydraulic flow characteristics due to its smoothness.

- A. Withstand corrosion      D. Transfer less friction  
B. Lower C factor      E. Brittle and is easily broken  
C. Withstand corrosion      F. None of the Above

66. ACP main disadvantage is that it is \_\_\_\_\_ during construction or by shock loading.

- A. Very light weight      D. Transfer less friction  
B. Lower C factor      E. Brittle and is easily broken  
C. Unable to withstand corrosion      F. None of the Above

67. According to the text, ACP has some concern regarding the possible release of asbestos fibers in corrosive water and there has much debate over the health effects of ingested asbestos.

- A. True      B. False

68. Precautionary measures must be taken to protect water utility workers when cutting, tapping or otherwise handling this type of pipe.

- A. True      B. False

### Galvanized Pipe

69. Galvanized pipe is commonly used for the water distributing pipes inside a building to supply hot and cold water to?

- A. The fixtures      D. To copper fittings  
B. Water distributing pipes      E. The water heater  
C. Inside and outside      F. None of the Above

70. Galvanized pipe is manufactured in 21-ft lengths and is coated with zinc the outside only.

- A. True      B. False

71. Pipe sizes are based on nominal inside diameters, these diameters vary with the thickness of the pipe.

- A. True      B. False

72. According to the text, outside pipe diameters remain constant so that pipe can be?

- A. Hooked to Cpex      D. Soldered to copper fittings  
B. Flanged      E. Threaded for standard fittings  
C. Connected to Sharkbites      F. None of the Above

### Stage 2 DBP Rule Federal Register Notices

73. Which of the following rules is part of the Microbial and Disinfection Byproducts Rules, which are a set of interrelated regulations that address risks from microbial pathogens and disinfectants/disinfection byproducts?

- A. Groundwater Rule (GWR)      D. Long Term 2 Enhanced Surface Water Treatment Rule (LT2)  
B. Compliance      E. Interim Enhanced Surface Water Treatment Rule  
C. The Stage 2 DBP rule      F. None of the Above



74. 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 DBPR                      D. Long Term 2 Enhanced Surface Water Treatment Rule  
 B. DBP exposure                      E. Traditional disinfection practices  
 C. The Stage 2 DBP rule            F. None of the Above
75. The Stage 1 Disinfectants and Disinfection Byproducts Rule and \_\_\_\_\_, promulgated in December 1998.
- A. Major public health advances    D. Amendments to the SDWA in 1996  
 B. The Stage 2 DBPR                    E. Interim Enhanced Surface Water Treatment Rule  
 C. This final rule                        F. None of the Above
76. This rule will apply to all community water systems and nontransient non-community water systems that add a primary or residual disinfectant other than \_\_\_\_\_ or deliver water that has been disinfected by a primary or residual disinfectant other than UV.
- A. Ultraviolet (UV) light                D. UV source  
 B. The open-channel system            E. UV radiation  
 C. UV rather than ozone                F. None of the Above
77. Which of the following rules has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water?
- A. Stage 2 DBPR                      D. Long Term 2 Enhanced Surface Water Treatment Rule  
 B. DBP exposure                      E. Safe Drinking Water Act (SDWA)  
 C. The Stage 2 DBP rule            F. None of the Above
78. Which of the following terms is one of the major public health advances in the 20th century?
- A. Major public health advances    D. Amendments to the SDWA in 1996  
 B. The Stage 2 DBPR                    E. Primary or residual disinfectant  
 C. Disinfection of drinking water    F. None of the Above
79. There are specific microbial pathogens, such as \_\_\_\_\_, which can cause illness, and are highly resistant to traditional disinfection practices.
- A. Enteric virus(es)    D. C. perfringens  
 B. Oocyst(s)            E. E. coli host culture  
 C. Cryptosporidium    F. None of the Above
80. Which of the following rules targets systems with the greatest risk and builds incrementally on existing rules?
- A. Stage 2 DBPR                      D. Long Term 2 Enhanced Surface Water Treatment Rule  
 B. The rule                              E. Traditional disinfection practices  
 C. The Stage 1 DBP rule            F. None of the Above
81. Which of the following rules is being promulgated simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule to address concerns about risk tradeoffs between pathogens and DBPs?
- A. Major public health advances    D. Amendments to the SDWA in 1996  
 B. The Stage 2 DBPR                    E. Primary or residual disinfectant  
 C. This final rule                        F. None of the Above

82. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) builds upon the \_\_\_\_\_ to address higher risk public water systems for protection measures beyond those required for existing regulations.

- A. Stage 2 DBPR
- B. DBP exposure
- C. Stage 1 DBPR
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Traditional disinfection practices
- F. None of the Above

83. Which of the following rules and the Long Term 2 Enhanced Surface Water Treatment Rule are the second phase of rules required by Congress?

- A. Major public health advances
- B. The Stage 2 DBPR
- C. This final rule
- D. Amendments to the SDWA in 1996
- E. Primary or residual disinfectant
- F. None of the Above

84. Which Rule will reduce potential cancer and reproductive and developmental health risks from disinfection byproducts (DBPs) in drinking water, which form when disinfectants are used to control microbial pathogens?

- A. Stage 3 DBPR
- B. DBP exposure
- C. Stage 2 Disinfection Byproducts
- D. Long Term 2 Enhanced Surface Water
- E. Traditional disinfection practices
- F. None of the Above

85. Which Rule strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5)?

- A. Major public health advances
- B. The Stage 3 DBPR
- C. Stage 2 Disinfection Byproducts
- D. Amendments to the SDWA in 1996
- E. Primary or residual disinfectant
- F. None of the Above

**What does the rule require?**

86. Under the \_\_\_\_\_, systems will conduct an evaluation of their distribution systems, known as an Initial Distribution System Evaluation.

- A. Stage 2 DBPR
- B. DBP exposure
- C. The Stage 1 DBP rule
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Traditional disinfection practices
- F. None of the Above

87. Compliance with the maximum contaminant levels for two groups of disinfection byproducts (TTHM and HAA5), referred to as?

- A. TTHM and HAA5
- B. DBP MCLs
- C. Locational running annual average (LRAA)
- D. Disinfection byproducts (DBPs)
- E. Trihalomethanes and haloacetic acids
- F. None of the Above

88. Which of the following rules also requires each system to determine if they have exceeded an operational evaluation level, which is identified using their compliance monitoring results?

- A. Stage 2 DBPR
- B. DBP exposure
- C. The Stage 1 DBP rule
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Traditional disinfection practices
- F. None of the Above

**Who must comply with the rule?**

89. Entities potentially regulated by the \_\_\_\_\_ are community and nontransient noncommunity water systems that produce and/or deliver water that is treated with a primary or residual disinfectant other than ultraviolet light.

- A. DBPs from chlorination
- B. Chlorine and chloramine
- C. Stage 2 DBPR
- D. Classes of DBPs
- E. TTHM and HAA5
- F. None of the Above

90. Which of the following terms is a public water system that serves year-round residents of a community, subdivision, or mobile home park that has at least 15 service connections or an average of at least 25 residents?

- A. Trailer park
- B. A non-community water system
- C. A community water system (CWS)
- D. NTNCWS
- E. A nontransient water system
- F. None of the Above

91. Which of the following terms is a water system that serves at least 25 of the same people more than six months of the year, but not as primary residence, such as schools, businesses, and day care facilities?

- A. Trailer park
- B. A non-community water system
- C. A community water system (CWS)
- D. NTNCWS
- E. A nontransient water system
- F. None of the Above

**Microbial Regulations**

92. One of the key regulations developed and implemented by the United States Environmental Protection Agency (USEPA) to counter pathogens in drinking water is the Surface Water Treatment Rule which requires that a public water system, using surface water (or ground water under the direct influence of surface water) as its source, have sufficient treatment to reduce the source water concentration of Giardia and viruses by at least 99.9% and 99.99%, respectively.

- A. True
- B. False

93. Which rule specifies treatment criteria to assure that these performance requirements are met; they include turbidity limits, disinfectant residual, and disinfectant contact time conditions?

- A. Long Term 1 Rule
- B. Maximum Contaminant Level Goal (MCLG)
- C. Stage 1 Byproducts Rule
- D. Surface Water Treatment Rule
- E. Interim Enhanced Surface Water
- F. None of the Above

94. Which rule was established to maintain control of pathogens while systems lower disinfection byproduct levels to comply with the Stage 1 Disinfectants/Disinfection Byproducts Rule and to control Cryptosporidium?

- A. Long Term 1 Enhanced Surface Water Treatment Rule
- B. Maximum Contaminant Level Goal (MCLG)
- C. Stage 1 Disinfectants/Disinfection Byproducts Rule
- D. Surface Water Treatment Rule
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

95. The EPA established a MCL of 0.0010 for all public water systems and a 99% removal requirement for Cryptosporidium in filtered public water systems that serve at least 100,000 people. The new rule tightened turbidity standards back in December 2001.

- A. True
- B. False

96. Color is an indicator of the physical removal of particulates, including pathogens.

A. True      B. False

97. Which rule improves physical removal of Cryptosporidium, and to maintain control of pathogens?

A. Long Term 1 Enhanced Surface Water Treatment Rule

B. Maximum Contaminant Level Goal (MCLG)

C. Stage 1 Disinfectants/Disinfection Byproducts Rule

D. Surface Water Treatment Rule

E. Interim Enhanced Surface Water Treatment Rule

F. None of the Above

### **New EPA Rules for Distribution**

#### **Reduction of Lead in Drinking Water Act**

98. The Reduction of Lead in Drinking Water Act means municipalities, water districts and developers who work with and pay for water infrastructure need to be preparing.

A. True    B. False

99. Lead, a metal found in natural deposits, is commonly used in household plumbing materials and water service lines.

A. True    B. False

100. Lead in drinking water can also cause a variety of adverse health effects. In babies and children, exposure in drinking water above the action level can result in delays in physical and mental development, along with slight deficits in attention span and learning abilities. In adults, it can cause increases in blood pressure.

A. True    B. False

101. The most common problem is with brass or chrome-plated brass faucets and fixtures is that these can leach significant amounts of lead into the water, especially cold water.

A. True    B. False

102. Homes built before 1999 are more likely to have lead pipes, fixtures and solder.

A. True    B. False

103. New homes are also at risk: even legally “lead-free” plumbing may contain up to 8 percent lead.

A. True    B. False

104. Reduction of Lead in Drinking Water Act, is to amend the Safe Drinking Water Act regarding the use and introduction into commerce of lead pipes, plumbing fittings or fixtures, solder and flux.

A. True    B. False

105. This lead reduction law was established January 4, 2014, which provided a three-year timeframe for affected parties to transition to the new requirements.

A. True    B. False

### **Pervasive Environmental Contaminant**

106. Lead can be ingested from various sources, including lead paint and house dust contaminated by lead paint, as well as soil, drinking water, and food.

A. True    B. False

107. Because lead accumulates in the body, all sources of lead should be controlled or eliminated to prevent childhood lead poisoning.

- A. True B. False

108. Beginning in the 1970s, lead concentrations in air, tap water, food, dust, and soil began to be substantially reduced, resulting in significantly reduced blood lead levels in children throughout the United States.

- A. True B. False

109. Homes built before the 1978 homes might contain lead paint hazards, as well as drinking water service lines made from lead, or plumbing materials that contain lead.

- A. True B. False

110. Which of the following terms control reduces the leaching of lead plumbing components or solder into drinking water?

- A. Lead concentrations D. Water infrastructure  
B. Adequate corrosion E. Safe Drinking Water Act (SDWA)  
C. Lead enforcement F. None of the Above

### Composite Meters

111. Composite meters are one example of a \_\_\_\_\_ alternative that is not susceptible to no-lead regulations.

- A. Lead free D. Zero lead  
B. New lead-free law E. Lead-free alternative material  
C. New low-lead brass F. None of the Above

112. Composite meters do not depend on metal pricing fluctuations and have zero lead as opposed to low lead or even \_\_\_\_\_ meters.

- A. Bronze D. "Friction feeling"  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

113. Which of the following terms does this type of meter boast longevity and resistance to corrosion from aggressive water?

- A. Bronze D. Composite  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

114. Composite meters are constructed using a blend of plastic and?

- A. Bronze D. "Friction feeling"  
B. "Lead-free" E. Fiberglass  
C. Zero lead F. None of the Above

115. Which of the following terms have been found to eliminate the "friction feeling" typically experienced with metal threads and metal couplings, facilitating easier installation?

- A. Bronze D. Composite threads  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

116. With comprehensive testing, composite meters have demonstrated a burst pressure that is significantly greater than?

- A. Bronze D. Composite  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

117. Composite technology today allows for better, more environmentally friendly composite products that will last up to 10 years in residential applications.

- A. True B. False

118. Which of the following term or zero lead products on the market and it is critical that utilities consider all of their options when selecting a new fleet of meters?

- A. Bronze D. Friction  
B. Lead-free E. Plastic and fiberglass  
C. Zero lead F. None of the Above

119. Everyone deserves access to safe, clean water.

- A. True B. False

120. According to the text, it is essential that manufacturers deliver products that meet the highest standards for safety, quality, reliability and accuracy to ensure availability to, and conservation of?

- A. Frequency of sampling D. An adequate chlorine residual  
B. Their personal health E. This most precious resource  
C. Water system customers F. None of the Above

121. To ensure that drinking water supplied by all public water supply systems as defined by the EPA meet Federal and State requirements, water system operators are required to collect samples regularly and?

- A. Frequency of sampling D. An adequate chlorine residual  
B. Their personal health E. Byproduct chemicals  
C. Have the water tested F. None of the Above

122. The regulations specify maximum sampling frequencies, sampling locations, testing procedures, methods of keeping records, and frequency of reporting to the State.

- A. True B. False

123. The regulations also mandate special reporting procedures to be followed if a contaminant exceeds \_\_\_\_\_.

- A. An MCL D. Continuous chlorine residual  
B. Chemical analyses E. No concern for byproducts  
C. Turbidity F. None of the Above

124. According to the text, about half the distribution systems must provide periodic monitoring for microbiological contaminants and some chemical contaminants.

- A. True B. False

125. The frequency of sampling and the chemicals that must be tested for depend on the physical size of the water system, \_\_\_\_\_, and the history of analyses.

- A. Frequency of sampling D. An adequate chlorine residual  
B. The water source E. Byproduct chemicals  
C. Water system customers F. None of the Above

### **Bacteriological Monitoring Section**

#### **Repeat Sampling**

126. Repeat sampling replaces the old check sampling with a more comprehensive procedure to try to \_\_\_\_\_ areas in the system.

- A. Double check the routine sample D. Sample  
B. Identify problem E. Calculate MCL compliance  
C. Originate the sampling location F. None of the Above

127. According to the text, whenever a Routine sample is total coliform or fecal coliform present, a set of repeat samples must be collected within \_\_\_\_\_ hours after being notified by the laboratory.

- A. 12
- B. 24
- C. 48
- D. 10
- E. 2
- F. None of the Above

The follow-up for repeat sampling is:

128. If only one \_\_\_\_\_ per month or quarter is required, four (4) repeat samples must be collected.

- A. Routine sample
- B. Surface water sample
- C. Original sample
- D. Sample
- E. MCL sample
- F. None of the Above

129. For systems collecting two (2) or more routine samples per month, three (3) \_\_\_\_\_ must be collected.

- A. Routine samples
- B. Surface water samples
- C. Samplers
- D. Repeat samples
- E. MCL compliance calculations
- F. None of the Above

130. Repeat samples must be collected from:

The original sampling location of the \_\_\_\_\_.

- A. Routine sample
- B. Surface water
- C. Coliform present sample
- D. Sample
- E. MCL area
- F. None of the Above

131. Within five (5) service connections upstream from the \_\_\_\_\_.

- A. Routine sample
- B. Surface water
- C. Original sampling location
- D. Sample
- E. MCL location
- F. None of the Above

132. Within five (5) service connections downstream from the \_\_\_\_\_.

- A. Routine sample site
- B. Surface water location
- C. Original sampling location
- D. Sample area
- E. MCL compliance area
- F. None of the Above

133. Samples should be taken elsewhere in the \_\_\_\_\_ or at the wellhead, if necessary.

- A. Sewage system
- B. Surface system
- C. Sampling location
- D. Distribution system
- E. MCL compliance calculation
- F. None of the Above

134. In a very small system if the system has only \_\_\_\_\_, the repeat samples must be collected from the same sampling location over a four-day period or on the same day.

- A. Routine water
- B. Surface water
- C. One sampling location
- D. One service connection
- E. MCL compliance zone
- F. None of the Above

135. If a repeat sample is necessary, all repeat samples are included in the \_\_\_\_\_.

- A. Routine sample
- B. Surface water
- C. Original sampling location
- D. Sample
- E. MCL compliance calculation
- F. None of the Above

136. Generally speaking, and depending on your State, if a system which normally collects fewer than five (5) routine samples per month has a coliform present sample; it must collect five (5) routine samples the following \_\_\_\_\_ regardless of whether a MCL violation occurred or if repeat sampling was coliform absent.
- A. Week
  - B. Hour
  - C. Immediately
  - D. Day
  - E. Month or quarter
  - F. None of the Above

**Positive or Coliform Present Results**

137. According to the text, if you are notified of a positive test result you need to contact either the Drinking Water Program or your local county health department within 24 hours, or by the next business day after the \_\_\_\_\_.

- A. Results are reported to you
- B. Positive violation
- C. Repeat sampling immediately
- D. Sample violation
- E. MCL compliance violation
- F. None of the Above

138. Ideally speaking, your Drinking Water Program Agency should contract with health departments to provide \_\_\_\_\_ to water systems.

- A. Assistance
- B. Harassment
- C. Hostility
- D. Sample help
- E. Compliance calculation
- F. None of the Above

139. Hopefully 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. Storage and distribution
- B. Repeat sampling immediately
- C. Upgrading of the wellhead area
- D. Perform routine procedures
- E. Corrective measures
- F. None of the Above

**Spread Plate Method**

140. During this method, colonies are on the \_\_\_\_\_ where they can be distinguished readily from particles and bubbles.

- A. Agar surface
- B. Surface growth area
- C. Top
- D. Bottom
- E. Material
- F. None of the Above

141. During the Spread Plate Method, colonies can be transferred quickly, and \_\_\_\_\_ easily can be discerned and compared to published descriptions.

- A. Colonies grow
- B. Surface growth
- C. Low counts
- D. Heterotrophic organisms will grow
- E. Colony morphology
- F. None of the Above

**Membrane Filter Method**

142. This method permits testing large volumes of \_\_\_\_\_ and is the method of choice for low-count waters.

- A. Colonies
- B. Surface water
- C. Low-turbidity water
- D. Heterotrophic organisms
- E. MCL
- F. None of the Above



### Heterotrophic Plate Count (Spread Plate Method)

143. Which of the following terms use inorganic carbon sources, this is in contrast to Heterotrophic organisms utilize organic compounds as their carbon source?

- A. Colonies
- B. Surface growth
- C. AGAR
- D. Heterotrophic organisms
- E. Autotrophic organisms
- F. None of the Above

144. Which of the following terms provides a technique to quantify the bacteriological activity of a sample.

- A. Colonies
- B. Heat
- C. Agar
- D. Heterotrophic Plate Count
- E. MCL
- F. None of the Above

145. After an incubation period, a bacteriological colony count provides an estimate of the concentration of heterotrophs in the sample of interest. The R2A agar provides a medium that will support a large variety of?

- A. Colonies
- B. Bugs
- C. Germs
- D. Heterotrophic bacteria
- E. MCL
- F. None of the Above

### Total Coliforms

146. This MCL is based on the presence of total coliforms, and compliance is on a daily or weekly basis, depending on your water system type and state rule.

- A. True
- B. False

147. For systems that 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. 5
- B. 10
- C. 100
- D. 200
- E. 40
- F. None of the Above

148. For systems that collect \_\_\_\_\_ or more samples per month, no more than five (5) percent may be Positive, check with your state drinking water section or health department for further instructions.

- A. 5
- B. 10
- C. 100
- D. 200
- E. 40
- F. None of the Above

### Acute Risk to Health (Fecal coliforms and E. coli)

149. Which of the following terms to human health violation occurs if either one of the following happens? (questions 150-153)

- A. Routine analysis
- B. Drinking violation
- C. Acute risk
- D. Human health violation
- E. Fecal coliform or E. coli is present
- F. None of the Above

150. A routine analysis shows total coliform present and is followed by a repeat analysis that indicates?

- A. Routine analysis
- B. Drinking violation
- C. Water penalty
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

151. A routine analysis shows total and \_\_\_\_\_ is followed by a repeat analysis that indicates total coliform present.

- A. Routine analysis
- B. Drinking water violation
- C. MCL violation
- D. Human health violations
- E. Fecal coliform or E. coli present
- F. None of the Above

152. Which of the following terms requires the water system to provide public notice via radio and television stations in the area?

- A. Routine analysis violation
- B. Drinking water rule violation
- C. MCL violation
- D. Human health violation
- E. Acute health risk violation
- F. None of the Above

153. According to the text, the type of contamination can pose an immediate threat to human health and notice must be given as soon as possible, but no later than 24 hours after notification from your laboratory of the test results.

- A. True
- B. False

### Public Notice

154. A public notice is required to be issued by a water system whenever it fails to comply with an applicable MCL or \_\_\_\_\_, or fails to comply with the requirements of any scheduled variance or permit.

- A. Routine analysis
- B. Drinking water rule
- C. Treatment technique
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

155. Which term best describes what also is required whenever a water system fails to comply with its monitoring and/or reporting requirements or testing procedure?

- A. Routine analysis
- B. Drinking water rule
- C. MCL violation
- D. Public notice
- E. Fecal coliform or E. coli present count
- F. None of the Above

156. There shall be certain information, be issued properly and in a timely manner, and contain certain \_\_\_\_\_ on the public notice.

- A. Legal analysis
- B. Drinking water rule information
- C. NOVs
- D. Mandatory language
- E. Fecal language
- F. None of the Above

157. Which of the following terms present to users, the timing and place of posting of the public notice may have different priorities?

- A. Routine analysis
- B. Drinking water rule
- C. Acute risk
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

### The following are acute violations:

158. Which is violation of nitrate?

- A. Presence
- B. MCL
- C. MCLG
- D. Count
- E. Acute violations
- F. None of the Above

159. Concerning total coliforms - when fecal coliforms or E. coli are present in the distribution system and is a violation of the?

- A. Presence
- B. MCL
- C. MCLG
- D. Count
- E. Acute violations
- F. None of the Above

160. Any outbreak of \_\_\_\_\_, as defined by the rules.

- A. Total coliforms
- B. MCL
- C. Waterborne disease
- D. Radioactive bacteria
- E. Acute violations
- F. None of the Above

### **Water Well Reports and Hydrogeology**

#### **Hydrogeologic Data**

161. For hydrogeologists to make reliable assessments about the current and future status of ground water, they need to know where ground water occurs in the subsurface, what the properties are of the various geologic units below the surface, and how fast and in what direction ground water is moving.

- A. True
- B. False

#### **Depth to the Aquifer**

162. It is important to know the type of geologic materials that occur from the surface down to the top of the?

- A. Aquifer
- B. Hydraulic head
- C. Geologic materials
- D. Amount of recharge to the aquifer
- E. Ground water
- F. None of the Above

#### **Nature of the Aquifer**

163. An unconfined aquifer has which missing term 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. A confined aquifer
- D. Hydraulic conductivity
- E. Permeability, or hydraulic conductivity
- F. None of the Above

#### **Depth to First Water-Bearing Zone**

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

- A. The drill hole
- B. SWL
- C. The yield
- D. Recharge and discharge zone(s)
- E. Hydrogeologic investigation(s)
- F. None of the Above

#### **Static Water Level**

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

- A. Static water level (SWL)
- B. Data on the well report
- C. Local ground water systems
- D. Perforated portions of cased wells
- E. Weak (fractured) zones
- F. None of the Above

166. Identifying where one aquifer ends and another begins is key to identifying the source of the yield for individual wells. Although this often can be determined by careful review of the lithologic log provided by the well constructor, the transition from one aquifer to the next can be indicated by a marked change in the recharge and discharge zones

- A. True
- B. False

167. Which of the following terms is a better indicator that a different aquifer has been encountered than the lithologic description?

- A. Drill hole
- B. SWL
- C. The yield
- D. Recharge and discharge zone(s)
- E. Hydrogeologic investigation(s)
- F. None of the Above

168. Which of the following terms have important implications in ground water protection and identifying the relation between area ground water and local streams?

- A. Weak (fractured) zones
- B. SWL
- C. The yield
- D. Recharge and discharge zone(s)
- E. Hydrogeologic investigation(s)
- F. None of the Above

### **Water-Bearing Zones**

169. 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

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

- A. Water-bearing zone(s)
- B. SWL
- C. Yield
- D. Recharge and discharge zone(s)
- E. Hydrogeologic investigation(s)
- F. None of the Above

### **Lithologic Log**

171. The well log portion of the well report describes what the driller encountered in the subsurface.

- A. True
- B. False

### **Contributions of Well Constructors to Hydrogeology**

172. This document stresses the importance of data that is recorded on well reports and how that data influences hydrogeologic investigations.

- A. True
- B. False

173. Well constructors can provide important contributions to the science by making careful observations and measurements when recording that data on the?

- A. Static water level
- B. Well report
- C. Local ground water systems
- D. Perforated portions of cased wells
- E. Weak (fractured) zones
- F. None of the Above

### **How Wells Are Drilled**

174. A few examples of today's more common well drilling methods include rotary, auger, and cable tool with?

- A. Many variations of each
- B. Typical drilling fluid(s)
- C. Advanced methods
- D. A highly trained and skilled driller
- E. Today's more common well drilling methods
- F. None of the Above

175. Drilling fluids are often used during drilling in order to keep the borehole open while drilling is done.

- A. True
- B. False

176. Air rotary with \_\_\_\_\_ is particularly suited for hard rock drilling, while mud rotary is better suited for drilling in sediment.

- A. Downhole hammer
- B. The Kelly
- C. The table drive
- D. A sub
- E. Rotary bit
- F. None of the Above

## Basic Rotary Drilling Methods

177. Rotary drilling utilizes two methods that include: direct and reverse mud rotary, direct air rotary, and?

- A. Rotary drilling
- B. Typical drilling fluid(s)
- C. Advanced methods
- D. Drill through casing driver methods
- E. Today's more common well drilling methods
- F. None of the Above

## The Rotary Drill String

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

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber (floating sub)
- E. A kelly
- F. None of the Above

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

- A. The flighting
- B. The plug
- C. The bucket
- D. A kelly
- E. The cutting head
- F. None of the Above

180. Which of the following terms 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. Drilling method
- B. The Kelly
- C. The table drive
- D. A sub
- E. Rotary bit
- F. None of the Above

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

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber (floating sub)
- E. The drill string
- F. None of the Above

182. Drill pipe can be used in various lengths but are typically 20-foot sections and may be connected to the drive unit with?

- A. Drilling method
- B. The Kelly
- C. The table drive
- D. A sub
- E. Rotary bit
- F. None of the Above

183. A sub is a length of pipe used to connect pipes and/or act as shock absorber (between the drill pipes and drive unit, at the end of the drill pipe is?

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber
- E. The kelly
- F. None of the Above

184. Which of the following terms or stabilizer is typically very heavy and is often gauged close to the diameter of the bit being used?

- A. Drilling method
- B. The Kelly
- C. The table drive
- D. The drill collar
- E. Rotary bit
- F. None of the Above

185. Which of the following terms aids in maintaining a consistent borehole diameter and primarily helps to prevent borehole deviation?

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber (floating sub)
- E. The kelly
- F. None of the Above

186. Several types of bits may be used; such as drag bits or?

- A. The flighting
- B. The plug
- C. Roller bits
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

187. Which of the following terms are typically used in unconsolidated to semi-consolidated sand, silt, and clay-rich formations?

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber (floating sub)
- E. The kelly
- F. None of the Above

188. Drag bits come in many shapes and sizes and cut with a shearing action aided by the jetting of drilling fluids from?

- A. The drill collar
- B. Drag bit(s)
- C. Nozzles or jets in the bit
- D. Shock absorber (floating sub)
- E. The kelly
- F. None of the Above

189. Roller bits, such as \_\_\_\_\_, typically utilize interlocking teeth or buttons on individual rotating cones to cut, crush, or chip through the formation.

- A. The flighting
- B. The plug
- C. The bucket
- D. The common tri-cone bit
- E. The cutting head
- F. None of the Above

190. Roller bits can be used in consolidated formations and even hard rock applications if equipped with carbide buttons. These types of bits are often referred to as?

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber (floating sub)
- E. Roller button bits
- F. None of the Above

191. Which of the following terms are bits that can be used to enlarge, straighten, or clean an existing borehole?

- A. Drilling method
- B. The Kelly
- C. The table drive
- D. Reamers
- E. Rotary bit
- F. None of the Above

192. Which of the following terms are used to enlarge deeper sections of an existing borehole without requiring the enlargement of the entire upper well bore?

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. Shock absorber (floating sub)
- E. Under reamers
- F. None of the Above

193. Under reaming involves the projection of \_\_\_\_\_ beneath permanently installed casing in loosely consolidated sediments.

- A. Cutting blades
- B. The Kelly
- C. The table drive
- D. A sub
- E. Rotary bit
- F. None of the Above

### Direct Rotary Method

194. Direct rotary drilling methods utilize a rotating bit at the end of a drilling string with drilling fluid that is circulated from the rig through the drill pipe and jets in the bit.

- A. True
- B. False

195. Down-force exerted by the drilling rig and/or the weight of this missing term is used along with rotating action to force the bit downwards, cutting through the sediment or rock.

- A. Direct Mud rotary drilling rig(s)
- B. Bit
- C. Large drill rig(s)
- D. Drill string
- E. Loss of mud drilling fluids
- F. None of the Above

196. The drilling fluid that is pumped by \_\_\_\_\_ and/or air compressor is jetted out of ports in the bit.

- A. The fighting
- B. The rig's mud pump
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

197. 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

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

- A. Rotary drilling
- B. Typical drilling fluid(s)
- C. Advanced methods
- D. A highly trained and skilled driller
- E. The drilling fluid
- F. None of the Above

199. 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 fighting
- B. The plug
- C. The bucket
- D. The drilling fluid
- E. The cutting head
- F. None of the Above

### **Direct Mud Rotary Method**

200. 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

201. The process of building up a film of mud on the borehole walls is not important to mud rotary drilling and is called mud balling.

- A. True
- B. False

202. Which of the following terms use various types of mud or drilling fluid to drill into the ground?

- A. The reverse method
- B. Zone(s)
- C. The mud drilling fluid
- D. The mud
- E. Direct Mud rotary drilling rig(s)
- F. None of the Above

203. Which of the following terms or set of screens called a shaker may be used in part of the recirculating system on larger rigs; it separates out cuttings from drilling fluid and provides an ideal sampling location?

- A. Direct Mud rotary drilling rig(s)
- B. A vibrating screen
- C. Large drill rig(s)
- D. A drilling string with drilling fluid
- E. The loss of mud drilling fluids
- F. None of the Above

204. Which of the following terms not only removes cuttings but also adheres to and pushes against the borehole walls, minimizes fluid loss, and cools the bit?

- A. The reverse method
- B. Zone(s)
- C. The mud drilling fluid
- D. The mud
- E. Direct Mud rotary drilling rig(s)
- F. None of the Above

205. Sometimes specially trained personnel are needed to manage the physical properties of the mud to ensure that a proper mud cake thickness is maintained and that a proper density or this missing term is used to efficiently drill the well.

- A. The reverse method
- B. Weight of mud
- C. The mud drilling fluid
- D. The mud
- E. Direct Mud rotary drilling rig(s)
- F. None of the Above

206. The mud engineer will often use bentonite clay and water to make the mud drilling fluid. Sometimes chemical additives such as \_\_\_\_\_ may be used.

- A. The reverse method
- B. Drilling polymers or gels
- C. The mud drilling fluid
- D. The mud
- E. Direct Mud rotary drilling rig(s)
- F. None of the Above

### **Reverse Mud Rotary Method**

207. Reverse mud rotary drilling is particularly applicable to hard rock aquifers in zones where highly fractured or weathered rock may prevent the efficient flow of drilling fluids up the borehole walls to the surface.

- A. True
- B. False

### **Air Rotary Method**

208. Air rotary methods utilize compressed air and derived drill cuttings and groundwater as the drilling fluid.

- A. True
- B. False

209. Which of the following terms is forced through the drill string and out the bit where it then mixes with and lifts cuttings and any derived groundwater to the surface?

- A. The air rotary method
- B. Soil or formation sample(s)
- C. Air
- D. Biodegradable foam or surfactant (soap)
- E. Mud
- F. None of the Above

210. The cuttings and groundwater are typically contained in subsurface pits, much like?

- A. Roller bit(s)
- B. Drilling
- C. The borehole
- D. The mud rotary method
- E. The reverse method
- F. None of the Above

211. Soil or formation samples may be collected in a bucket or shovel placed beneath the table of the rig as drilling proceeds, resulting in?

- A. The air rotary method
- B. Soil or formation sample(s)
- C. Representative samples
- D. Biodegradable foam or surfactant (soap)
- E. The total target depth
- F. None of the Above

212. Which of the following terms 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 plug
- C. The bucket
- D. The borehole
- E. The cutting head
- F. None of the Above



213. Which of the following terms is often 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. The air rotary method
- B. Soil or formation sample(s)
- C. Air
- D. Biodegradable foam or surfactant (soap)
- E. Mud
- F. None of the Above

214. 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

215. Which of the following terms action generates great rock breaking force and is very valuable for drilling through solid rock or consolidated formations?

- A. Roller bit(s)
- B. Drilling
- C. The borehole
- D. The mud rotary method
- E. The combined rotating and hammering
- F. None of the Above

216. Which of the following terms in hard rock or consolidated formations, may be used when drilling pressures are too high or borehole sizes are too large for the efficient operation of an air hammer?

- A. The flighting
- B. A roller button bit
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

#### **Drill through Casing Driver Method**

217. The drill through casing driver method drives casing into the borehole as the telescoping kelly advances.

- A. True
- B. False

218. Which of the following terms is a specially designed hardened steel ring that is installed on the casing end?

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The cutting shoe
- F. None of the Above

219. Which of the following terms is inserted into the casing and the casing is attached to the casing driver?

- A. A hammer or roller bit
- B. The drill string
- C. A casing driver
- D. The rig
- E. The addition of casing and drill string
- F. None of the Above

220. Which of the following terms penetrates into the overburden or formation, the casing driver hammers the casing down, following the drill string?

- A. The drill string
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

221. Which of the following terms may employ a hammer or roller bit?

- A. The flighting
- B. The plug
- C. The bucket
- D. The drill string
- E. The cutting head
- F. None of the Above

222. According to the text, cuttings rise to the surface with \_\_\_\_\_ through the casing and exit through the casing driver.

- A. The injected air
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

223. According to the text, as the borehole is drilled, the cuttings are then collected near?

- A. A hammer or roller bit
- B. The drill string
- C. A casing driver
- D. The rig
- E. The addition of casing and drill string
- F. None of the Above

224. Which of the following terms can continue until competent formation is encountered?

- A. A hammer or roller bit
- B. The drill string
- C. A casing driver
- D. The rig
- E. The addition of casing and drill string
- F. None of the Above

225. Which of the following terms is often used to install temporary casing in order to permit the installation of a well in unstable aquifers?

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

226. Which of the following terms may be used as a puller to remove the temporary casing following well construction?

- A. The flighting
- B. The plug
- C. The bucket
- D. The casing driver
- E. The cutting head
- F. None of the Above

### **Auger Boring Methods**

227. Auger boring methods make use of this missing term, which may be attached to a pilot bit and cutter head.

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. A rotating blade or spiral flange
- E. The bucket auger method
- F. None of the Above

228. Which of the following terms along with the rotating action of the blade and cutting action of the pilot and/or cutter bits facilitates the boring process?

- A. The flighting
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. Down-force applied by the rig
- F. None of the Above

229. Soil samples may be collected as cuttings rise or are brought to the surface, or they may be collected with?

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

230. Auger boring methods are commonly used to construct large diameter boreholes for the construction of surface seals around wells through thin and stable overburden sediments that overlie the aquifer below.

- A. True
- B. False

231. Which of the following terms are capable of boring large diameter holes in excess of four feet in diameter?

- A. Auger boring method(s)
- B. Augers
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

232. According to the text, there are three primary types of \_\_\_\_\_: solid stem, bucket, and hollow stem.

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

### **Solid Stem Auger Method**

233. Which of the following terms method uses a spiral flanged drill pipe driven by either a kelly or rotary drive head, like those used on rotary rigs?

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

234. Flanged sections of drill pipe are referred to as?

- A. Flighting
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

235. Which of the following terms typically employ a single flight and can be used in stable formations to depths of approximately 60 feet?

- A. The flighting
- B. The plug
- C. The bucket
- D. Larger diameter augers
- E. The cutting head
- F. None of the Above

236. Which of the following terms is removed from the borehole so that cuttings, which accumulate at the bottom of the borehole, may be removed and/or sampled?

- A. The flighting
- B. The lower flight
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

237. Samples may be collected from these cuttings or the flighting may be brought to the surface and samples collected from?

- A. The flighting
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

### **Bucket Auger Method**

238. Which of the following terms essentially combines the rotary and auger techniques?

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

239. Which of the following terms is rotated via a kelly and table drive much like those of rotary rigs?

- A. Auger boring method(s)
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger
- F. None of the Above

240. Which of the following terms consists of two or more sections of square piping that telescope into each other?

- A. The flighting
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

241. Which of the following terms is filled with cuttings it is closed and brought to the surface where it is swung out to the side of the rig by a specially designed swing arm?

- A. The flighting
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

242. Which of the following terms cannot be used in material containing cobbles and boulders, but is used most often in more stable semi consolidated silty or clay rich deposits?

- A. Bucket auger methods
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

### **Hollow Stem Auger Method**

243. Which of the following terms has been used in the geotechnical field for many years for its usefulness in obtaining soil samples?

- A. The hollow stem auger
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

244. Which of the following terms contains a plug that is connected to drill pipe that passes through the center of the flights and is ultimately connected to a top drive?

- A. The lowermost flight
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. The casing driver method
- E. The bucket auger method
- F. None of the Above

245. When the plug is removed, accurate soil samples may be obtained while the flighting remains to keep this open.

- A. The flighting
- B. The plug
- C. The bucket
- D. The borehole
- E. The cutting head
- F. None of the Above

246. Samples are typically collected with \_\_\_\_\_ driven into the soil a few feet ahead of the flighting.

- A. The flighting
- B. The plug
- C. The bucket
- D. A telescoping kelly
- E. A split spoon sampler or core barrel sampler
- F. None of the Above

247. Which of the following terms can also permit the installation of well screen and filter media in otherwise relatively unstable formations by its acting as temporary casing?

- A. The flighting
- B. The plug
- C. The bucket
- D. The use of larger diameter continuous flights
- E. The cutting head
- F. None of the Above

### What is a Significant Deficiency?

248. Significant deficiencies cause, or have the potential to cause, the introduction of contamination into water delivered to customers include defects in design, operation, or maintenance of?

- A. Well screen
- B. The aquifer
- C. A pumping test
- D. The amount of water production
- E. The source, treatment or distribution systems
- F. None of the Above

249. The rule requires each state to define and describe at least one type of specific significant deficiency for each of?

- A. The eight sanitary survey elements
- B. The aquifer
- C. A pumping test
- D. The amount of water production
- E. The optimum pumping rate
- F. None of the Above

250. EPA will develop guidance to help states carry out sanitary surveys and identify significant deficiencies that could affect the quality of drinking water.

- A. True
- B. False

### Selecting an Appropriate Well Site

251. 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

252. Which of the following terms 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. The quality of drinking water
- B. The possibility of contamination
- C. Surface drainage(s)
- D. All possible sources of contamination
- E. Preliminary aquifer parameters
- F. None of the Above

### Common Well Construction Specifications

253. Which of the following terms 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
- B. The aquifer
- C. A pumping test
- D. The amount of water production
- E. The optimum pumping rate
- F. None of the Above

254. Contamination of a water supply typically occurs when leachate from sewage systems or surface waters enter a well. Surface water may enter the well through an opening in the top or by seeping through?

- A. The quality of drinking water
- B. The possibility of contamination
- C. Surface drainage(s)
- D. Contamination of a water
- E. The shallow borehole walls
- F. None of the Above

255. Tests have shown that bacterial contamination is usually eliminated after filtering through 1000 feet of normal soil.

- A. True
- B. False

256. All wells must be constructed with a surface seal to prevent the infiltration of surface water and/or surface contaminants into?

- A. The anticipated flow rate
- B. The well
- C. Annulus and surface casing
- D. The well bore and aquifer
- E. The upper borehole from the surface
- F. None of the Above

257. Which of the following terms is installed in the upper portions of the well bore between the annulus and surface casing and will normally extend to the ground surface around the well?
- A. This seal                      D. The casing and screen specifications  
 B. The inflatable packer      E. Well screen(s)  
 C. The louver(s)                F. None of the Above
258. The installation of the cement or grout between the annulus and surface casing effectively seals off the upper borehole from?
- A. The anticipated flow rate                      D. The surface  
 B. The well    E. The upper borehole from the surface  
 C. Annulus and surface casing                      F. None of the Above
259. Which of the following terms uses is a solid piece of permanently installed casing, usually steel, that should be of sufficient size to allow the completion of the well within it?
- A. The surface casing      D. The casing and screen specifications  
 B. The inflatable packer      E. Well screen(s)  
 C. The louver(s)              F. None of the Above
260. Which of the following terms in addition to the surface seal is always installed with the pumping equipment to ensure no surface water or debris enters the well?
- A. A well seal or cap                      D. Unstable or non-productive areas  
 B. The well    E. The upper borehole from the surface  
 C. Annulus and surface casing      F. None of the Above
261. Specialized borehole geophysical logging equipment may be used to isolate the areas of optimum production capability and aid in determining the ultimate well design.
- A. True                      B. False
262. Which of the following terms following the installation, the well is then reamed to accept additional blank casing, well screen, and filter or gravel pack?
- A. The quality of drinking water                      D. The well's surface seal  
 B. The possibility of contamination                      E. Preliminary aquifer parameters  
 C. Surface drainage(s)                                      F. None of the Above
263. According to the text, blank casing is normally installed to the depth of?
- A. The quality of drinking water                      D. The main producing zone  
 B. The possibility of contamination                      E. Preliminary aquifer parameters  
 C. Surface drainage(s)                                      F. None of the Above
264. Which of the following terms may extend to the total depth of the well or may be used intermittently to total depth with blank casing used through unstable or non-productive areas?
- A. The anticipated flow rate                      D. Unstable or non-productive areas  
 B. The well    E. The upper borehole from the surface  
 C. Well screen    F. None of the Above
- Choice of Casing**
265. Which of the following terms needed is related to the type of aquifer, well depth, water quality, well use, and regulatory requirements?
- A. The type of well casing                      D. The casing and screen specifications  
 B. The inflatable packer                      E. Well screen(s)  
 C. The louver(s)                                      F. None of the Above

266. According to the text, 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      D. Unstable or non-productive areas  
B. The well      E. The upper borehole from the surface  
C. Gravel pack      F. None of the Above

267. A few of the more common types of well screen are: wire wrapped, continuous screen, slotted, louvered, and?  
A. The centralizer(s)      D. Perforated screens  
B. The inflatable packer      E. Well screen(s)  
C. The louver(s)      F. None of the Above

268. Which of the following terms are stronger and less expensive than wire wrapped screens and are best suited to deep applications, where borehole stability is a concern?  
A. The anticipated flow rate      D. Unstable or non-productive areas  
B. Slotted and perforated screens      E. The upper borehole from the surface  
C. Annulus and surface casing      F. None of the Above

### Selecting an Optimum Pumping Rate

269. The highest  $S_c$  observed is normally associated with?  
A. The anticipated flow rate      D. Unstable or non-productive areas  
B. The well      E. The upper borehole from the surface  
C. The optimum pumping rate      F. None of the Above

### Pump Selection Section

#### Three Basic Types of Wells

270. Which of the following terms are usually bored into an unconfined water source, generally found at depths of 100 feet or less?  
A. Unconsolidated or sand well(s)      D. Total dynamic or discharge head  
B. Bored or shallow well(s)      E. The most important components  
C. The proper selection      F. None of the Above

271. Which of the following terms are drilled into a formation consisting entirely of a natural rock formation that contains no soil and does not collapse?  
A. Consolidated or rock wells      D. Total equivalent feet of lift  
B. Screen filter(s)      E. The total friction head  
C. Power requirement(s)      F. None of the Above

272. Which of the following terms are drilled into a formation consisting of soil, sand, gravel, or clay material that collapses upon itself?  
A. Unconsolidated or sand well(s)      D. Total dynamic or discharge head  
B. Bored or shallow well(s)      E. The most important components  
C. The proper selection      F. None of the Above

273. The proper selection of pumping equipment for a well is of great importance.  
A. True    B. False

### Pumping Lift and Total Dynamic or Discharge Head

274. The most important components in selecting the correct pump for your application are: total pumping lift and?  
A. Cavitation      D. Total dynamic or discharge head  
B. Suction head      E. Pressure head  
C. Velocity head      F. None of the Above

275. Which of the following terms refers to the total equivalent feet of lift that the pump must overcome in order to deliver water to its destination, including frictional losses in the delivery system?

- A. Total dynamic head
- B. Screen filter(s)
- C. Power requirement(s)
- D. Total equivalent feet of lift
- E. The total friction head
- F. None of the Above

### **Basic Pump Operating Characteristics**

276. Which of the following terms refers to the height of a vertical column of water?

- A. Head
- B. Suction head
- C. Velocity head
- D. Loss of head
- E. Pressure head
- F. None of the Above

277. Which of the following terms of a pump is composed of several types of head that help define the pump's operating characteristics?

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Total head
- E. Pressure head
- F. None of the Above

### **Total Dynamic Head**

278. The total dynamic head of a pump is the sum of \_\_\_\_\_, the pressure head, the friction head, and the velocity head.

- A. The total static head
- B. Screen filter(s)
- C. Power requirement(s)
- D. Total equivalent feet of lift
- E. The total friction head
- F. None of the Above

279. The Total Dynamic Head is the sum of the total static head, \_\_\_\_\_ and the pressure head.

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Loss of head
- E. Total friction head
- F. None of the Above

### **Total Static Head**

280. The total static head is the total vertical distance the pump must lift the water.

- A. True
- B. False

### **Pressure Head**

281. Which of the following terms at any point where a pressure gauge is located can be converted from pounds per square inch to feet of head by multiplying by 2.31?

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Loss of head
- E. Pressure head
- F. None of the Above

### **Friction Head**

282. Friction head is the energy increase or pressure increase when water flows through pipe networks.

- A. True
- B. False

283. Which of the following terms occurs when water flows through straight pipe sections, fittings, valves, around corners, and where pipes increase or decrease in size?

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Loss of head
- E. Loss of head due to friction
- F. None of the Above



284. Values for these losses can be calculated or obtained from friction loss tables. The friction head for a piping system is the sum of all the?
- A. Friction head
  - B. Friction losses
  - C. Pressure head
  - D. Total dynamic or discharge head
  - E. Loss of head
  - F. None of the Above

### Velocity Head

285. Velocity head is the energy of the water due to?
- A. Cavitation
  - B. Suction head
  - C. Velocity head
  - D. Loss of head
  - E. Its velocity
  - F. None of the Above

### Suction Head

286. According to the text, a pump operating above a water surface is working with?
- A. Friction head
  - B. A suction head
  - C. Pressure head
  - D. Total dynamic or discharge head
  - E. Loss of head
  - F. None of the Above
287. There is an allowable limit to \_\_\_\_\_ on a pump and the net positive suction head of a pump sets that limit.
- A. Cavitation
  - B. Suction head
  - C. Velocity head
  - D. Loss of head
  - E. Pressure head
  - F. None of the Above

288. The theoretical maximum height that water can be lifted using suction is 21 feet.
- A. True
  - B. False

289. The NPSH curve will increase with increasing flow rate through the pump.
- A. True
  - B. False

290. At a certain flow rate, the NPSH is subtracted from 23 feet to determine the maximum suction head at which that pump will operate.
- A. True
  - B. False

291. Which of the following terms must also protect water quality between the source and the customer's tap?
- A. Distribution system
  - B. Water pressure
  - C. Fire protection
  - D. Hydropneumatic tanks and surge tanks
  - E. Cavitation
  - F. None of the Above

292. Care must be taken that no foreign material is introduced into the system during pipe laying operations. Pipe ends should be covered at the end of the work day or during interruptions of construction.
- A. True
  - B. False

### Chlorine Gas

#### Pathophysiology

293. 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. Generation of free oxygen radicals
  - B. Vapor from Chlorine gas
  - C. Effects of Hydrochloric acid
  - D. Water solubility
  - E. The odor threshold for chlorine
  - F. None of the Above

294. According to the text, 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. The gas
- D. The chemical species produced
- E. Plasma exudation
- F. None of the Above

295. Because chlorine gas is so dangerous, the odor threshold for chlorine is approximately?

- A. 1 parts per million (ppm)
- B. 3 parts per million (ppm)
- C. 10 parts per million (ppm)
- D. 3-5 parts per million (ppm)
- E. 0.3-0.5 parts per million (ppm)
- F. None of the Above

### Mechanism of Activity

296. The mechanisms of cellular injury are believed to result from the oxidation of functional groups in cell components, from reactions with tissue water to form \_\_\_\_\_, and from the generation of free oxygen radicals.

- A. Generation of free oxygen radicals
- B. Chlorine acid
- C. Hydrochloric acid
- D. A caustic effect
- E. Hypochlorous and hydrochloric acid
- F. None of the Above

297. 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

298. Chlorine gas should be stored in vented rooms that have panic bar equipped doors.

- A. True
- B. False

### Solubility Effects

299. Which of the following terms is highly soluble in water?

- A. Hydrochloric acid
- B. H<sub>2</sub>SO<sub>4</sub>
- C. Hypochloric acid
- D. Sodium hypochlorite solution
- E. Sulfuric Acid
- F. None of the Above

300. Because it is highly water soluble, Hypochlorous acid has an injury pattern similar to?

- A. Hydrochloric acid
- B. H<sub>2</sub>SO<sub>4</sub>
- C. Hypochloric acid
- D. Sodium hypochlorite solution
- E. Sulfuric Acid
- F. None of the Above

301. Which of the following terms may account for the toxicity of elemental chlorine and hydrochloric acid to the human body?

- A. Hydrochloric acid
- B. H<sub>2</sub>SO<sub>4</sub>
- C. Hypochloric acid
- D. Hypochlorous acid
- E. Sulfuric Acid
- F. None of the Above

### Early Response to Chlorine Gas

302. If you mix ammonia with chlorine gas, this compound reacts to form?

- A. Hypochlorous acid
- B. Chlorine gas
- C. Hydrochloric acid
- D. Sulfuric acid
- E. Chloramine gas
- F. None of the Above

303. The early response to the odor threshold for chlorine depends on the (1) concentration of chlorine gas, (2) duration of exposure, (3) water content of the tissues exposed, and (4) individual susceptibility.

- A. True
- B. False

### Immediate Effects

304. Which of the following answers is the best choice for the immediate effects of this substance's toxicity include acute inflammation of the conjunctivae, nose, pharynx, larynx, trachea, and bronchi?
- A. Hydrochloric acid      D. Sulfuric acid  
B. Chlorine gas            E. HOCL  
C. Hypochlorous gas      F. None of the Above

### Pathological Findings

305. Chlorine is a highly reactive gas.  
A. True    B. False

306. According to the text, treatment plants use \_\_\_\_\_ to reduce water levels of microorganisms that can spread disease to humans.
- A. HCl                                  D. Chlorine  
B. HOCl                                E. The hypochlorite ion (OCI-)  
C. High chlorine concentrations   F. None of the Above

307. Chlorine gas is greenish yellow in color and very toxic. It is heavier than air and will therefore sink to the ground if released from its container.  
A. True    B. False

308. Chlorine gas is sold as a compressed liquid, which is amber in color. Chlorine, as a solid, is heavier than water. If the chlorine liquid is released from its container it will quickly return back to its liquid state.  
A. True    B. False

309. Chlorine gas is the most expensive form of chlorine to use. The typical amount of chlorine gas required for water treatment is 1-16 mg/L of water.  
A. True    B. False

### Exposure

310. There is no threshold value for to sodium hypochlorite exposure. Various health effects occur after exposure to sodium hypochlorite.  
A. True    B. False

311. After prolonged exposure, the skin can become sensitive. Sodium hypochlorite is poisonous for water organisms. It is mutagenic and very toxic when it comes in contact with Ammonium salts.  
A. True    B. False

### Chemistry of Chlorination

312. The hypochlorite ion is a much weaker disinfecting agent than Hypochlorous acid, about 100 times less effective.  
A. True    B. False

313. 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                  D. "CT" disinfection concept  
B. CT actual                            E. Ratio of hypochlorous acid  
C. Free chlorine residual            F. None of the Above

314. Under normal water conditions, hypochlorous acid will also chemically react and break down into the hypochlorite ion.  
A. True    B. False

315. Temperature plays a small part in the acid ratio. Although the ratio of \_\_\_\_\_ is greater at lower temperatures, pathogenic organisms are actually harder to kill.

A. Hypochlorous acid                      D. Total chlorine  
B. The amount of chlorine                E. pH value and temperature  
C. Chlorine Demand                        F. None of the Above

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

A. Lower pH                                      D. Lower water temperature  
B. Hypochlorous acid                        E. The hypochlorite ion  
C. Higher water temperatures              F. None of the Above

### Types of Residual

317. This missing term is all the chlorine that is available for disinfection.

A. Chlorine residual                      D. Break-point chlorination  
B. Chlorine demand                      E. Total chlorine  
C. Free chlorine                          F. None of the Above

318. Total chlorine residual = free + \_\_\_\_\_.

A. Chlorine residual                      D. Combined chlorine residual  
B. Chlorine demand                      E. Total chlorine residual  
C. Free chlorine                          F. None of the Above

319. In water, there are always other substances (interfering agents) such as iron, manganese, turbidity, etc., which will combine chemically with the chlorine, these substances are called the?

A. Chlorine residual                      D. Break-point chlorination  
B. Chlorine demand                      E. Total chlorine residual  
C. Pathogen reduction                  F. None of the Above

320. According to the text, once chlorine molecules are combined with these interfering agents, they are not capable of disinfection. \_\_\_\_\_ is much more effective as a disinfecting agent.

A. Chlorine residual                      D. Break-point chlorination  
B. Chlorine demand                      E. Total chlorine residual  
C. Free chlorine                          F. None of the Above

321. Either a total or a \_\_\_\_\_ can be read when a chlorine residual test is taken,

A. Chlorine residual                      D. Break-point chlorination  
B. Chlorine demand                      E. Total chlorine residual  
C. Free chlorine residual                F. None of the Above

### Residual Concentration/Contact Time (CT) Requirements

322. Since monitoring for very low levels of pathogens in treated water is analytically very difficult, utilizing the \_\_\_\_\_ is recommended to demonstrate satisfactory treatment.

A. Free chlorine                          D. "CT" disinfection concept  
B. Total residual                          E. T10 of the process unit  
C. Free chlorine residual                F. None of the Above

323. \_\_\_\_\_ = Concentration (mg/L) x Time (minutes)

A. CT    D. Total chlorine  
B. The amount of chlorine                E. pH value and temperature  
C. Chlorine Demand                        F. None of the Above

324. The effective reduction in pathogens can be calculated by reference to standard tables of required?

- A. Free chlorine
- B. Total residual
- C. Free chlorine residual
- D. "CT" s
- E. T10 of the process unit
- F. None of the Above

325. The CT concept as developed by the United States Environmental Protection Agency (uses the combination of disinfectant residual concentration (mg/L) and the effective disinfection contact time (in minutes) to measure effective pathogen reduction.

- A. True
- B. False

### Calculation and Reporting of CT Data

326. Reduction Ratio should be reported, along with the appropriate pH, temperature, and?

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. Disinfectant residual
- E. T10 of the process unit
- F. None of the Above

327. Which of the following terms must be greater than 1.0 to be acceptable?

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. T10 of the process unit
- F. None of the Above

328. You can also calculate and record actual log reductions. Reduction Ratio = CT actual divide by?

- A. Reduction Ratio
- B. CT
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. CT required
- F. None of the Above

329. Which of the following terms shall be calculated daily, using either the maximum hourly flow and the disinfectant residual at the same time, or by using the lowest CT value if it is calculated more frequently.

- A. Free chlorine
- B. Total residual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. Disinfection CT values
- F. None of the Above

### Chlorine (DDBP)

330. 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. Break point and Free
- D. Free available chlorine and Combined Chlorine
- E. Combined chlorine and readily available
- F. None of the Above

331. Chloramines are formed by reactions with?

- A. Acid and  $\text{Cl}_2$
- B. Ammonia and  $\text{Cl}_2$
- C. THMS and  $\text{Cl}_2$
- D. Folic Acid and  $\text{Cl}_2$
- E. THMs and Haploidic acid
- F. None of the Above

332. While testing chlorine disinfection process, you will need to understand one especially important feature is the ease of overdosing to create a "\_\_\_\_\_ " concentration.

- A. Free available chlorine and Total
- B. Residual
- C. Break point and Free
- D. Free available chlorine and Combined Chlorine
- E. Combined chlorine and readily available
- F. None of the Above

333. According to the text, which type of chlorine residual concentration residuals from 0.1 to 0.5 ppm?

- A. Free available chlorine and Total
- B. Residual
- C. Break point and Free
- D. Free available
- E. Combined chlorine and readily available
- F. None of the Above

334. A typical chlorine residual is 2 ppm for this type of chlorine residual?

- A. Free available chlorine and Total
- B. Residual
- C. Break point and Free
- D. Combined Chlorine
- E. Combined chlorine and readily available
- F. None of the Above

### **Chlorine By-Products**

335. The most common chlorination by-products found in U.S. drinking water supplies are?

- A. Chlorate and Chlorite
- B. CO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub>
- C. Trihalomethanes (THMs)
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

### **The Principal Trihalomethanes are:**

336. Chloroform, bromodichloromethane, chlorodibromomethane, and bromoform. Other less common chlorination by-products include the haloacetic acids and haloacetonitriles. The amount of THMs formed in drinking water can be influenced by a number of factors, including the season and the source of the water.

- A. True
- B. False

337. THM concentrations are generally higher in winter than in summer, because concentrations of natural organic matter are greater and more chlorine is required to disinfect at colder temperatures.

- A. True
- B. False

### **Health Effects**

338. The available studies on health effects do not provide conclusive proof of a relationship between exposure to THMs and cancer or reproductive effects, but indicate the need for further research to confirm their results and to assess the potential health effects of chlorination by-products other than THMs.

- A. True
- B. False

### **Pump, Motor and Hydraulic Section**

#### **Hydraulic Principles Section**

339. Which of the following terms includes the behavior of all liquids, although it is primarily concerned with the motion of liquids.

- A. Fluids
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

340. Which of the following terms includes the manner in which liquids act in tanks and pipes, deals with their properties, and explores ways to take advantage of these properties.

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

341. Which of the following terms includes the study of liquids in motion, is concerned with such matters as friction and turbulence generated in pipes by flowing liquids?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

### **Barometric Loop**

342. The barometric loop is a loop in the piping system that effectively protects against backpressure.

- A. True B. False

343. The barometric loop may not be used to protect against backsiphonage.

- A. True B. False

### **General Pumping Fundamentals**

344. 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

### **Pump Definitions**

345. Which of the following definitions is a barrier that separates stages of a multi-stage pump?

- A. Gasket D. Inter-stage diaphragm  
B. Keyway E. Seal  
C. Bearing F. None of the Above

346. Which of the following definitions is a flat material that is compressed between two flanges to form a seal?

- A. Gasket D. Seal  
B. Keyway E. Bond  
C. Packing F. None of the Above

347. Which of the following definitions is the part of the pump that increases the speed of the fluid being handled?

- A. Packing D. Seal  
B. Impeller E. Outboard  
C. Inboard F. None of the Above

### **Pumps**

348. 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

349. There are many kinds of \_\_\_\_\_, and can be the most trouble-prone and complicated part of a pump.

- A. Rotors D. Air space  
B. Force pumps E. Valves  
C. Inlets F. None of the Above

### **Pump Categories**

350. According to the text, pumps may be classified based on the application they serve.

- A. True B. False

351. According to the text, all pumps may be divided into two major categories: (1) dynamic and (2)?

- A. Centrifugal D. Diaphragm  
B. Impeller E. Rotary  
C. Displacement F. None of the Above

### Basic Water Pump

352. According to the text, the centrifugal pumps work by spinning water around in a circle inside a?

- A. Vortex
- B. Cylinder
- C. Viscous drag pump
- D. Center of the impeller
- E. Cylindrical pump housing
- F. None of the Above

353. The pump makes the water spin by pulling it with an impeller.

- A. True
- B. False

354. The blades of this impeller project inward from an axle like the arms of a turnstile and, as the impeller spins, the water moves through it.

- A. True
- B. False

355. In a centrifugal pump, the water pressure at the edge of the turning impeller rises until it is able to keep water circling with the?

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Bernoulli's equation
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

356. In a centrifugal pump, as water drifts outward between the \_\_\_\_\_ of the pump, it must move faster and faster because its circular path is getting larger and larger.

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Bernoulli's equation
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

### Venturi (Bernoulli's law):

357. The area of the restriction in a venture will have a \_\_\_\_\_ than the enlarged area ahead of it.

- A. Inward force
- B. Lower pressure
- C. Viscous drag pump
- D. Center of the impeller
- E. Incompressible fluid
- F. None of the Above

358. Which of the following terms best describes a pump whose impeller has no vanes but relies on fluid contact with a flat rotating plate turning at high speed to move the liquid.

- A. Submersible
- B. Blower
- C. Viscous drag pump
- D. Rotary pump
- E. Bicycle pump
- F. None of the Above

### Types of Water Pumps

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

- A. True
- B. False

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

- A. Axial flow
- B. Submersible
- C. Rotary pump
- D. Turbine pump(s)
- E. Variable displacement pumps
- F. None of the Above

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

- A. Variable displacement pump
- B. Drive shaft
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above



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

- A. Spider bearing(s)
- B. Horsepower
- C. Impeller(s)
- D. Turbine pump(s)
- E. Desired pumping rate
- F. None of the Above

### Submersible Pumps

363. The pump shaft has a keyway in which the splined motor end shaft inserts, the motor is often bolted to the?

- A. Motor
- B. Pump shrouds
- C. Canned configurations
- D. Pump housing
- E. Number of stages
- F. None of the Above

364. The pump's intake is located between the motor and the pump and is normally screened to prevent sediment from entering the pump and damaging the?

- A. Impellers
- B. Shroud
- C. Pump's intake
- D. Pump bowl assembly
- E. VHS or VSS motors
- F. None of the Above

365. These types of pumps are often installed such that flow through the \_\_\_\_\_ can occur upwards past the motor and into the intake.

- A. Well screen
- B. Pump shrouds
- C. Volute
- D. Pump housing
- E. Number of stages
- F. None of the Above

### Understanding the Operation of a Vertical Turbine Pump

366. Turbine pump efficiencies are comparable to or greater than most centrifugal pumps, these are usually more expensive than centrifugal pumps and more difficult to inspect and repair.

- A. True
- B. False

367. According to the text, the intake for the turbine pump is continuously under water, priming is not a concern.

- A. True
- B. False

368. According to the text, the turbine pump has three main parts: (1) the \_\_\_\_\_, (2) the shaft and column assembly and (3) the pump bowl assembly.

- A. Head assembly
- B. Shroud
- C. Pump's intake
- D. Pump bowl assembly
- E. VHS or VSS motors
- F. None of the Above

369. The head is normally cast iron and designed to be installed on a foundation. It supports the column, shaft, and bowl assemblies, and provides a discharge for the water.

- A. True
- B. False

370. The head will support either an electric motor, a \_\_\_\_\_ or a belt drive.

- A. Right angle gear drive
- B. Pump shrouds
- C. Canned configurations
- D. Pump housing
- E. Number of stages
- F. None of the Above

### Stuffing Box Adjustment

371. The nuts should only be tightened about  $\frac{1}{2}$  turn at a time at 20 to 30 minute intervals to allow the packing to?

- A. Run in
- B. Stuffing box
- C. Correct alignment
- D. Any deviation in performance
- E. Gravity flow system
- F. None of the Above

372. A new set of ring packing will need to be added to keep the?

- A. Packing gland
- B. Box full
- C. Impending trouble
- D. Lineshaft bearings
- E. Variances
- F. None of the Above

373. According to the text, after adding two or three rings of packing, or when proper adjustment cannot be achieved, the \_\_\_\_\_ should be cleaned completely of all old packing and re-packed.

- A. Periodic inspection
- B. Stuffing box
- C. Correct alignment
- D. Any deviation in performance
- E. Gravity flow system
- F. None of the Above

### Lineshaft Lubrication

374. According to the text, the oil reservoir must be kept filled with a good quality \_\_\_\_\_ and adjusted to feed 10 to 12 drops per minute plus one (1) drop per 100' of setting.

- A. Packing gland
- B. Oil reservoir
- C. Impending trouble
- D. Lineshaft bearings
- E. Light turbine oil
- F. None of the Above

375. Injection systems are designed for each installation — injection pressure and quantity of lubricating liquid will vary.

- A. True
- B. False

### General Maintenance Section

376. Which of the following terms out of vertical alignment may also cause excessive bearing wear?

- A. Periodic inspection
- B. Stuffing box
- C. Correct alignment
- D. Pump column
- E. Gravity flow system
- F. None of the Above

377. Which of the following terms must be mounted on a good foundation at least 12 inches above the ground surface?

- A. Packing gland
- B. Oil reservoir
- C. Impending trouble
- D. Lineshaft bearings
- E. Head assembly
- F. None of the Above

378. The foundation should have at least 12 inches of bearing surface on all sides of the well. In the case of a gravel-packed well, the 12-inch clearance is measured from the outside edge of the?

- A. Periodic inspection
- B. Stuffing box
- C. Correct alignment
- D. Gravel packing
- E. Gravity flow system
- F. None of the Above

### Centrifugal Pump

379. A Centrifugal pump is a machine that imparts energy to a fluid. This energy infusion can cause a liquid to flow, rise to a higher level, or both.

- A. True
- B. False

380. The centrifugal pump is an extremely simple machine. It is a member of a family known as rotary machines and consists of two basic parts: 1) the rotary element or impeller and 2) the stationary element or?

- A. Staging
- B. Eye
- C. Pressure
- D. Lantern ring spacer
- E. Casing (volute)
- F. None of the Above

381. In operation, a centrifugal pump “\_\_\_\_\_” liquid out of the impeller via centrifugal force.

- A. Web of the ring
- B. Slings
- C. Pump shaft
- D. Vapor bound
- E. Single-stage pump
- F. None of the Above

382. Which of the following terms are fitted on the shaft between the packing gland and the pump bearing housing?

- A. Staging
- B. Water flinger rings
- C. Seals
- D. Lantern ring spacer
- E. Packing gland
- F. None of the Above

383. These flingers prevent water in the \_\_\_\_\_ from flowing along the shaft and entering the bearing housing.

- A. Web of the ring
- B. Stuffing box
- C. Pump shaft
- D. Stage
- E. Volute
- F. None of the Above

### Centrifugal Pump

384. As the impeller rotates, it sucks the liquid into the center of the pump and throws it out under pressure through the?

- A. Web of the ring
- B. Outlet
- C. Pump shaft
- D. Vapor bound
- E. Single-stage pump
- F. None of the Above

385. The casing that houses the impeller is referred to as the \_\_\_\_\_, the impeller fits on the shaft inside.

- A. Staging
- B. Eye
- C. Volute
- D. Lantern ring spacer
- E. Recirculation lines
- F. None of the Above

### NPSH - Net Positive Suction Head

386. The vapor pressure of water at 95 degrees C is 84.53 kPa, there was enough suction to contain the vapor, but once the atmospheric pressure dropped at the higher elevation, the vapor was able to escape.

- A. True
- B. False

387. NPSH(r) is the Net Positive Suction Head Required by the pump, which is read from the?

- A. Pump suction
- B. Speed
- C. Suction conditions
- D. Pump performance curve
- E. Hydraulic efficiency
- F. None of the Above

### Affinity Laws

388. According to the text, the discrepancy between the \_\_\_\_\_ and the actual values obtained in test are due to hydraulic efficiency changes that result from the modification.

- A. Calculated values
- B. Speed
- C. Suction conditions
- D. Rotational speed
- E. Hydraulic efficiency
- F. None of the Above

389. Which of the following terms give reasonably close results when the changes are not more than 50% of the original speed or 15% of the original diameter?

- A. Centrifugal Pump
- B. Transmit tension
- C. Most economical
- D. Atmospheric pressure
- E. Laws of Affinity
- F. None of the Above

390. Which of the following terms are some of the most important factors affecting centrifugal pump operation?

- A. Pump suction
- B. Speed
- C. Suction conditions
- D. Rotational speed
- E. Hydraulic efficiency
- F. None of the Above

### Suction Lift

391. According to the text, atmospheric pressure at sea level is called absolute pressure because it is a measurement using absolute zero) as a base.

- A. True
- B. False

392. The vapor pressure of a liquid is the pressure necessary to keep the liquid from vaporizing at a given temperature.

- A. True
- B. False

### Cavitation - Two Main Causes:

393. Suction or discharge recirculation. The pump is designed for a certain flow range, if there is not enough or too much flow going through the pump, the resulting \_\_\_\_\_ can reduce performance and damage the pump.

- A. Pump suction
- B. Speed
- C. Suction conditions
- D. Turbulence and vortexes
- E. Hydraulic efficiency
- F. None of the Above

### Affinity laws

394. The flow changes proportionally to speed.

- A. i.e.: double the speed / multiply the pressure by 4
- B. i.e.: double the speed / double the flow
- C. i.e.: double the speed / multiply the power by 8
- D. None of the Above

### Pump Casing

395. The line shaft turbine is really a single stage centrifugal pump.

- A. True
- B. False

396. There are many variations of split case, such as; two-stage, single suction, and?

- A. Radial flow impellers
- B. Double suction
- C. Parallel
- D. Mixed media
- E. Multi media
- F. None of the Above

### **D-C Motors**

397. The important characteristic of the D-C motor is that its speed will not vary with the amount of current used.

- A. True    B. False

398. There are many different kinds of D-C motors, depending on how they are wound and their totally enclosed motors.

- A. True    B. False

### **A-C Motors**

399. There are a number of different types of alternating current motors, such as Synchronous, Induction, wound rotor, and?

- |                         |                            |
|-------------------------|----------------------------|
| A. Bubler pipe          | D. Totally enclosed motors |
| B. Manual pump controls | E. Squirrel cage           |
| C. Wound rotor type     | F. None of the Above       |

400. Which of the following terms of A-C motor requires complex control equipment, since they use a combination of A-C and D-C?

- |                     |                                    |
|---------------------|------------------------------------|
| A. Heat generated   | D. Speed/torque characteristics    |
| B. Synchronous type | E. Full voltage or reduced voltage |
| C. Motor(s)         | F. None of the Above               |