

Registration form

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

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

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

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

Water Distribution ___ Water Treatment ___ Other _____

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

State Approval Listing URL...

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

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

AFFIDAVIT OF EXAM COMPLETION

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

Grading Information

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

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

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

Distribution Survey Answer Key

Name _____

Phone _____

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

No refunds

You are responsible to ensure this course is accepted for credit.

Method of Course acceptance confirmation. Please fill this section

Website ___ Telephone Call ___ Email ___ Spoke to _____

Did you receive the approval number, if applicable? _____

What is the course approval number, if applicable? _____

You can electronically complete this assignment in Adobe Acrobat DC.

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

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

Signature

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

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

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CUSTOMER SERVICE RESPONSE CARD**

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

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

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

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How did you hear about this Course? _____

What would you do to improve the Course?

Any other concerns or comments.

**Please fax the answer key to TLC Western Campus
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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 / SDWA regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to be in compliance with your regulatory agencies and do not follow this course for any compliance concerns.

Distribution Survey CEU Training Course Assignment

The Distribution Survey CEU course assignment is available in Word on the Internet for your convenience, please visit www.abctlc.com and download the assignment and e-mail it back to TLC.

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

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

Hyperlink to the Glossary and Appendix

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

Cross-Connection Section

What is Backflow?

- Which of the following can have two forms-backpressure and backsiphonage?
A. Backflow C. Cross-connection
B. Backpressure D. None of the above
- The basic mechanism for preventing backflow is a mechanical _____, which provides a physical barrier to backflow.
A. Air gap C. Backflow
B. Backflow preventer D. None of the above
- 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 C. Cross-connection
B. Indirect connection D. None of the above
- Which of the following can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?
A. Backsiphonage C. Cross-connection
B. Backpressure D. None of the above
- Which of the following is a type of backflow caused by a downstream pressure that is greater than the upstream or supply pressure in a public water system or consumer's potable water system?
A. Backflow C. Indirect connection
B. Backpressure D. None of the above
- Which of the following can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both?
A. Backflow C. Backsiphonage
B. Backpressure D. None of the above

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

Types of Backflow Prevention Methods and Assemblies

13. Which of the following must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?
- A. Indirect connection C. Cross-connection
B. Jumper D. None of the above
14. The type of device selected for a particular backflow installation depends on several factors.
- A. True B. False
15. When the _____ is restricted, such as the case of an air gap located near a wall, the air gap separation must be increased.
- A. Air break C. Airflow
B. Barrier to backflow D. None of the above
16. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of a(n)?
- A. Open receiving vessel C. Barrier to backflow
B. Air break D. None of the above

17. Which of the following must be at least two times the diameter of the supply pipe and not less than one inch?
 A. Open receiving vessel C. Air gap
 B. Air break D. None of the above
18. 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
19. According to the text, air gap separations must be vertically orientated a distance of at least twice the inside diameter of the supply, but never less than?
 A. 1 inch C. 12 inches
 B. 2 inches D. None of the above
20. An obstruction around or near an _____ may restrict the flow of air into the outlet pipe and nullify the effectiveness of the air gap to prevent backsiphonage.
 A. Open receiving vessel C. Air gap
 B. Air break D. None of the above
21. An air gap is acceptable for _____ and is theoretically the most effective protection.
 A. High hazard installations C. Low pollutional hazards
 B. High pollutional concerns D. None of the above

Vacuum Breakers

22. Which of the following devices can have two primary types: atmospheric and pressure.
 A. Vacuum breaker(s) C. Hazard application(s)
 B. Atmospheric vacuum breakers D. None of the above
23. Both vacuum breakers devices primary purpose is to protect the water system from cross connections due to submerged inlets, such as irrigation systems and tank applications.
 A. True B. False
24. Both vacuum breakers devices open the pipeline to atmosphere in the event of backsiphonage only.
 A. True B. False
25. Both vacuum breakers devices are approved for backpressure conditions.
 A. True B. False
26. The Atmospheric vacuum breaker allows air to enter the water line when the line pressure is reduced to a gauge pressure of zero or below.
 A. True B. False
27. To prevent the air inlet from sticking open, the device must not be installed on the pressure side of a shutoff valve, or wherever it may be under constant pressure more than 2 hours during a 12-hour period.
 A. True B. False
28. Atmospheric vacuum breakers Uses: Irrigation systems, commercial dishwasher and laundry equipment, chemical tanks and laboratory sinks.
 A. True B. False

29. Pressure Vacuum Breaker Assembly (PVB) consists of a weighted check valve, an independently operating relief valve, two resilient seated shutoff valves, and two properly located resilient seated test cocks.
A. True B. False
30. The PVB needs to be installed 12 inches above the service or supply line to work correctly.
A. True B. False
31. Double Check Valve Assembly (DC) consists of two internally loaded check valves, either spring loaded or internally weighted, two resilient seated full ported shutoff valves, and four properly located resilient seated test cocks
A. True B. False
32. The double check valve assembly is designed to prevent backflow caused by backpressure and backsiphonage from high health hazards.
A. True B. False
33. Reduced Pressure Backflow Assembly (RP) consists of two independently acting spring loaded check valves separated by a Spring loaded differential pressure relief valve, two resilient seated full ported shutoff valves, and four properly located resilient seated test cocks.
A. True B. False
34. During normal operation, the pressure between the two check valves, referred to as the air inlet zone, is maintained at a higher pressure than the supply pressure.
A. True B. False
35. If either reduced pressure backflow assembly check valve leaks, the differential pressure relief valve maintains a differential pressure of at least two (2) psi between the supply pressure and the zone between the two check valves by discharging water to atmosphere.
A. True B. False
36. According to the text, the reduced pressure backflow assembly or RP is designed to prevent backflow caused by backpressure and backsiphonage from low to high health hazards.
A. True B. False
37. According to the text, the RP needs to be installed 12 inches above the ground for testing purposes only.
A. True B. False
38. The reduced pressure backflow assembly can be used for high hazard situations under backpressure only. Under normal conditions, the second check valve should never close.
A. True B. False
39. According to the text, if the second check valve fails or becomes fouled and backflow into the reduced pressure zone occurs, the relief port vents the backflow to atmosphere.
A. True B. False
40. According to the text, the reduced pressure zone port opens anytime pressure in the zone comes within 2 psi of the supply pressure.
A. True B. False

41. Both vacuum breakers devices are only suitable for?
 A. High hazard installations C. Low hazard conditions
 B. High polluttional concerns D. None of the above
42. Which of the following may not be installed downstream of atmospheric vacuum breakers but are allowed on pressure vacuum breakers?
 A. Valve assembly C. Air inlet valve
 B. Shut offs D. None of the above
43. The devices must be installed above the highest?
 A. Downstream piping C. Hazard applications
 B. Vacuum breakers D. None of the above

Water Distribution Section

System Elements

44. Booster stations are used to _____ from storage tanks for low-pressure mains.
 A. Increase water pressure C. Provide a reserve pressure
 B. Equalize D. None of the above
45. In the distribution system, storage reservoirs are structures used to store water and _____ the supply or pressure.
 A. Increase water pressure C. Provide a reserve pressure for
 B. Equalize D. None of the above

Butterfly Valve

46. Butterfly valves are rotary type of valves usually found on large transmission lines, and may also have an additional valve beside it known as a _____ to prevent water hammer.
 A. Regulator C. PRV
 B. Bypass D. None of the above

Water Distribution Valves

47. According to the text, at intersections of distribution mains, the number of valves required is normally one less than the number of?
 A. Ties C. Depends on customers
 B. Radiating mains D. None of the above

Gate Valves

48. If the valve is wide open, the gate inside the valve is _____ into the valve bonnet.
 A. Fully drawn up C. Fully closed
 B. Fully down D. None of the above
49. There is little pressure drop or flow restriction through gate valves; however, gate valves are not suitable for?
 A. Pressure drops C. Throttling purposes
 B. Isolation D. None of the above

Ball Valves

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

Valve Exercising

51. Valve exercising should be done once per year to locate inoperable valves due to freezing or build-up of rust or corrosion and to detect minimum flow restriction and to prevent valves from becoming frozen or damaged.

- A. True B. False

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

- A. True B. False

53. Over-pressurization of a valve is when a valve can _____ when high pressure enters the cavity and has no way to escape.

- A. Positive pressure differential C. Lock in the closed position
B. Lock in the open position D. None of the above

54. Corrosion increases the C-Factor and the carrying capacity in a pipe.

- A. True B. False

Common Rotary Valves

55. Globe valve is a rotary valve and is rare to find in most distribution systems, but is found at water treatment plants.

- A. True B. False

56. Most Globes are compact OS & Y types, bolted bonnet, rising stems, with renewable seat rings.

- A. True B. False

Water Pressure

57. 2.31 feet of water is equal to 1 psi, or 1 foot of water is equal to about a half a pound (.433 pounds to be exact).

- A. True B. False

58. For ordinary domestic use, water pressure should be between 25 and 45 psi.

- A. True B. False

59. 20 psi is the minimum pressure required at any point in the water system, so that _____ is prevented.

- A. Cavitation C. Backflow and infiltration
B. Back pressure D. None of the above

60. Which of the following is provided from the direct force of the water, or by the height of the water?

- A. Pressure C. Maximum daily use
B. System integrity D. None of the above

Water Use or Demand

61. Water system demand comes from many sources including residential, commercial, industrial and public consumers as well as waste and some?

- A. Pressure C. Unavoidable loss
B. System integrity D. None of the above

62. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for pressure at all times.
A. True B. False

63. The quantity of water used in any community varies from 100 to 200 gallons per person per day.
A. True B. False

64. A common design usage assumption is to plan for the usage of 100 to 150 gallons per person per day for average domestic use.
A. True B. False

65. The maximum daily use is approximately 3 to 5 times the average daily use.
A. True B. False

66. Which of the following is usually encountered during the summer months and can vary widely depending on irrigation practices?
A. Maximum daily use C. Unavoidable loss and waste
B. Minimum daily use D. None of the above

Water Storage Introduction

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

Storage and Distribution

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

Water Storage Facilities

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

70. Which of the following can be converted to pressure potential energy or kinetic energy for delivery to homes?
A. Hydrostatic power C. Hydraulic power
B. Stored energy D. None of the above

Storage Reservoirs

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

Steel Reservoirs

72. Steel reservoirs or tanks generally have higher construction and installation costs than concrete, and require less maintenance.

- A. True B. False

73. Steel tanks should be inspected once a year and repainted every 5-7 years.

- A. True B. False

Groundwater Treatment/Production System Section

Groundwater and Wells

74. When toxic substances are spilled or dumped near a well, these can leach into _____ and contaminate the groundwater drawn from that well.

- A. Karst C. Soil moisture
B. Aquifer D. None of the above

75. Which of the following flows slowly through water-bearing formations at different rates?

- A. Groundwater C. Soil moisture
B. Drinking water D. None of the above

76. The level below which all the spaces in the ground are filled with water is called the?

- A. Unconfined aquifer(s) C. Well(s)
B. Water table D. None of the above

77. The area above the water table lies the?

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

78. The water in the saturated zone is called?

- A. Unconfined aquifer(s) C. Water table
B. Groundwater D. None of the above

79. Which of the following terms are cracks, joints, or fractures in solid rock, through which groundwater moves?

- A. Fractured aquifer(s) C. Soil moisture
B. Karst D. None of the above

80. Limestone is often located in which of the following?

- A. Unconfined aquifer(s) C. Fractured aquifer(s)
B. Soil moisture D. None of the above

81. Which of the following may move in different directions below the ground than the water flowing on the surface?

- A. Water table C. Soil moisture
B. Groundwater D. None of the above

82. Which of the following is the level to which the water in an artesian aquifer will rise?

- A. Aquifer C. Water table
B. Piezometric surface D. None of the above

83. Sandstone may become so highly cemented or recrystallized that all of the original space is filled, in this case, the rock is no longer a porous medium and is known as?

- A. Unconfined aquifer(s)
- B. Porous media
- C. Fractured aquifer(s)
- D. None of the above

84. Unconfined aquifers are those that are bounded by the water table. Some aquifers lie beneath layers of impermeable materials.

- A. True
- B. False

85. A well inside an aquifer is an artesian well.

- A. True
- B. False

86. Clay has many spaces between its grains, but the spaces are not large enough to permit free movement of water.

- A. True
- B. False

87. Which of the following usually flows downhill along the slope of the water table?

- A. Groundwater
- B. Water table
- C. Soil moisture
- D. None of the above

Cone of Depression

88. During pumping, the water level in the well falls below the water table in the?

- A. Water table
- B. Surrounding aquifer
- C. Unconfined aquifer
- D. None of the above

89. The movement of water from _____ into a well results in the formation of a cone of depression.

- A. Confined aquifer
- B. An aquifer
- C. Water table
- D. None of the above

90. Which of the following describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?

- A. Water table
- B. Groundwater
- C. Cone of depression
- D. None of the above

91. Which of the following is the vertical drop in the height between the water level in the well prior to pumping and the water level in the well during pumping?

- A. Drawdown
- B. Groundwater
- C. Cone of depression
- D. None of the above

92. When a water well is installed in _____, water moves from the aquifer into the well through small holes or slits in the well casing or, in some types of wells, through the open bottom of the well?

- A. Confined aquifer
- B. An unconfined aquifer
- C. Water table
- D. None of the above

Where Is Ground Water Stored?

93. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, that literally means?

- A. Water table
- B. Water bearer
- C. Cone of depression
- D. None of the above

94. Which of the following stores water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?
A. Water table C. Unconfined aquifer
B. Aquifer(s) D. None of the above

95. Which of the following is regulated largely by its porosity, or the relative amount of open space present to hold water?
A. Water table C. An aquifer's storage capacity
B. Groundwater D. None of the above

96. If the aquifer is sandwiched between layers of comparatively impermeable materials, it is called?
A. Confined aquifer C. Water table
B. Unconfined aquifer D. None of the above

97. Which of the following are frequently found at greater depths than unconfined aquifers?
A. Confined aquifer(s) C. Water table
B. Unconfined aquifer(s) D. None of the above

Does Groundwater Move?

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

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

Groundwater Quality

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

How Does Ground Water Become Contaminated?

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

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

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

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

104. A substantial number of today's groundwater contamination problems stem from man's activities and can be introduced into ground water from?

- A. Contaminant(s)
- B. Saturated zone
- C. A variety of sources
- D. None of the above

Abandoned Wells

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

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

What Can Be Done After Contamination Has Occurred?

106. Rehabilitate the _____ by either restraining or detoxifying the contaminants while they are still in the aquifer.

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

Water Well Reports and Hydrogeology

Nature of the Aquifer

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

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

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

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

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

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

Hydraulic Head (h)

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

- A. True
- B. False

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

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

Permeability of the Aquifer (K)

112. Which of the following _____ or the permeability of the aquifer is a measure of how fast ground water can move through the aquifer?

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

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

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

In What Direction Is Groundwater Flowing?

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

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

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

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

What Is the Drawdown Associated with Pumping of a Well?

116. There is a relationship between the pumping rate of the well, the transmissivity of the aquifer, the distance between wells, _____, and the duration of the pumping event.

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

Depth to First Water-Bearing Zone

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

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

Static Water Level

118. The driving force for ground water movement is the hydraulic head, and the _____ is a measure of that force.

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

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

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

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

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

Water-Bearing Zones

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

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

Lithologic Log

122. 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

123. The well report document stresses the importance of data that is recorded on well reports and how that data influences hydrogeologic investigations.

- A. True B. False

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

- A. Static water level C. Local ground water systems
B. Well report D. None of the above

How Wells Are Drilled

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

- A. True B. False

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

- A. True B. False

Basic Rotary Drilling Methods

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

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

The Rotary Drill String

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

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

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

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

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

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

131. Some rotary rigs use a top drive to turn _____ and are like a drill press.

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

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

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

133. 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 C. Shock absorber
B. Drag bit(s) D. None of the above

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

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

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

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

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

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

137. Which of the following are normally 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. None of the above

138. 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. Nozzles or jets in the bit
- C. Shock absorber (floating sub)
- D. None of the above

139. 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 common tri-cone bit
- D. None of the above

140. 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. Roller button bits
- B. The Kelly
- C. Reamers
- D. None of the above

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

- A. Roller button bits
- B. The Kelly
- C. Reamers
- D. None of the above

142. 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. Cutting blades
- B. Under reamers
- C. Reamers
- D. None of the above

143. Under reaming involves the projection of _____ beneath permanently installed casing in loosely consolidated sediments.

- A. Cutting blades
- B. Under reamers
- C. Reamers
- D. None of the above

Direct Rotary Method

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

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

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

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

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

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

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

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

Direct Mud Rotary Method

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

- A. True
- B. False

Air Rotary Method

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

- A. True
- B. False

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

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

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

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

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

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

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

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

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

Drill through Casing Driver Method

155. The drill through casing driver method drives casing into the borehole as the telescoping kelly advances.
- A. True
 - B. False

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

- A. Auger boring method(s)
- B. The cutting shoe
- C. The casing driver method
- D. None of the above

157. Which of the following 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. The rig
- D. None of the above

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

- A. The drill string
- B. The cutting shoe
- C. The casing driver method
- D. None of the above

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

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

160. Cuttings rise to the surface with _____ through the casing and exit through the casing driver.

- A. The injected air
- B. The solid stem auger boring method
- C. The casing driver method
- D. None of the above

161. 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. The rig
- D. None of the above

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

- A. A hammer or roller bit
- B. The drill string
- C. The addition of casing and drill string
- D. None of the above

163. Which of the following 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. The casing driver method
- C. A rotating blade or spiral flange
- D. None of the above

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

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

Auger Boring Methods

165. Auger boring methods make use of _____, which may be attached to a pilot bit and cutter head.

- A. Auger boring method(s)
- B. The casing driver method
- C. A rotating blade or spiral flange
- D. None of the above

166. Which of the following 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. Down-force applied by the rig
- D. None of the above

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

- A. Augers
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. None of the above

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

- A. Augers
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. None of the above

169. According to the text, there are three primary types of _____: solid stem, bucket, and hollow stem.

- A. Auger boring method(s)
- B. The bucket auger method
- C. The casing driver method
- D. None of the above

Solid Stem Auger Method

170. 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. Augers
- B. Split spoon type sampler(s)
- C. The solid stem auger boring method
- D. None of the above

What is a Significant Deficiency?

171. 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. The source, treatment or distribution systems
- D. None of the above

Selecting an Appropriate Well Site

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

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

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

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

Common Well Construction Specifications

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

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

Choice of Casing

175. 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
- B. The well
- C. Gravel pack
- D. None of the above

Selecting an Optimum Pumping Rate

176. Specific capacities for each of the pumping steps are compared. The highest Sc observed is normally associated with?

- A. The anticipated flow rate
- B. The well
- C. The optimum pumping rate
- D. None of the above

Pump and Motor Section

Common Hydraulic Terms

177. Which of the following definitions is the engineering science pertaining to liquid pressure and flow?

- A. Hydraulics
- B. Hydrology
- C. Hydrokinetics
- D. None of the above

178. Which of the following definitions is the pressure exerted by the atmosphere at any specific location?

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Pressure, Gauge
- D. None of the above

179. Which of the following definitions is pressure above zero absolute, i.e. the sum of atmospheric and gauge pressure?

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Pressure, Gauge
- D. None of the above

180. Which of the following definitions is the force per unit area, usually expressed in pounds per square inch?

- A. Pressure, Absolute
- B. Pressure
- C. Pressure, Gauge
- D. None of the above

181. Which of the following definitions is the pressure differential above or below ambient atmospheric pressure?

- A. Pressure, Absolute
- B. Pressure
- C. Pressure, Gauge
- D. None of the above

182. Which of the following definitions is height of a column or body of fluid above a given point expressed in linear units?

- A. Head, Friction
- B. Head, Static
- C. Head
- D. None of the above

183. Which of the following definitions is required to overcome the friction at the interior surface of a conductor and between fluid particles in motion?

- A. Head, Friction
- B. Head, Static
- C. Head
- D. None of the above

184. Which of the following definitions is the pressure in a fluid at rest?

- A. Head, Friction
- B. Pressure, Static
- C. Head
- D. None of the above

185. Which of the following definitions is the height of a column or body of fluid above a given point?

- A. Head, Friction
- B. Head, Static
- C. Head
- D. None of the above

186. Sea level pressure is approximately 2.31 pounds per square inch absolute, 1 bar = .433psi.

- A. True
- B. False

General Pumping Fundamentals

187. 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

188. According to the text, suction lift is when the level of water to be pumped is below the?

- A. Impeller
- B. Suction
- C. Centerline of the pump
- D. None of the above

189. The suction side of pipe should be one diameter smaller than the pump inlet.

- A. True
- B. False

190. The required eccentric reducer should be turned so that the top is flat and the bottom tapered.

- A. True
- B. False

Pumps

191. 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

192. Pumps are excellent examples of?

- A. Hydrostatics
- B. Quasi-static devices
- C. Multi-stage pumps
- D. None of the above

193. More complicated pumps have valves check valves that open to allow _____, and close automatically to prevent reverse flow.

- A. Pistons
- B. Diaphragms
- C. Passage in one direction
- D. None of the above

194. According to the text, the force pump has _____ in the cylinder, one for supply and the other for delivery.

- A. Two check valves
- B. Diaphragms
- C. Rotors
- D. None of the above

195. In a positive displacement pump, supply valve opens when the cylinder _____, the delivery valve when the cylinder volume decreases.

- A. Volume increases
- B. Volume decreases
- C. Air space increases
- D. None of the above

Pump Categories

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

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

197. With a centrifugal pump the pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called?

- A. Inward force
- B. Head
- C. Delivery force
- D. None of the above

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

- A. True
- B. False

Basic Water Pump

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. True
- B. False

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

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

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

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

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

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

206. In the operation of the pump, the water at the edge of the _____ inward on the water between the impeller blades and makes it possible for that water to travel in a circle.
- A. Inward force
 - B. Pump pushes
 - C. Center of the impeller
 - D. None of the above

Venturi (Bernoulli's law):

207. Which of the following 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. None of the above

Types of Water Pumps

208. The most common type of water pumps used for municipal and domestic water supplies are?
- A. Axial flow
 - B. Variable displacement pumps
 - C. Rotary pumps
 - D. None of the above

209. Which of the following will produce at different rates relative to the amount of pressure or lift the pump is working against?
- A. Pump's lifting capacity
 - B. Atmospheric pressure
 - C. Variable displacement pump
 - D. None of the above

210. Impellers are rotated by the pump motor, which provides the _____ needed to overcome the pumping head.
- A. Pump's lifting capacity
 - B. Atmospheric pressure
 - C. Horsepower
 - D. None of the above

211. The size and number of stages, horsepower of the motor and _____ are the key components relating to the pump's lifting capacity.
- A. Pumping head
 - B. Atmospheric pressure
 - C. Horsepower
 - D. None of the above

212. Which of the following terms are variable displacement pumps that are by far used the most?
- A. Axial flow
 - B. Centrifugal pumps
 - C. Turbine pumps
 - D. None of the above

213. According to the text, the turbine pump utilizes impellers enclosed in single or multiple bowls or stages to?
- A. Pump head
 - B. Lift water
 - C. Horsepower
 - D. None of the above

214. Vertical turbine pumps are commonly used in groundwater wells. These pumps are driven by a shaft rotated by a motor on the surface.
- A. True
 - B. False

215. The shaft turns the impellers within the pump housing while the?
- A. Desired pumping rate is obtained
 - B. Horsepower turns the shaft
 - C. Water moves up the column
 - D. None of the above

216. The size of the _____ are selected based on the desired pumping rate and lift requirements.
- A. Impeller(s)
 - B. Lantern ring
 - C. Column, impeller, and bowls
 - D. None of the above

217. According to the text, column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by?
- A. Column pipe C. Lantern ring
B. Spider bearings D. None of the above
218. The water passing through the column pipe serves as the lubricant for the bearings.
- A. True B. False
219. The water production well industry almost exclusively uses Turbine pumps, which are a type of centrifugal pump.
- A. True B. False
220. Careful operation of oil lubricated turbines is needed to ensure that the pumping levels do not drop enough to allow oil to enter the pump.
- A. True B. False
221. Which of the following terms, provide both a seal at the column pipe joints and keep the shaft aligned within the column?
- A. Column pipe C. Lantern ring
B. Spider bearings D. None of the above
222. The oil tube is suspended within the column by _____, while the line shaft is supported within the oil tube by brass or redwood bearings.
- A. Column pipe C. Spider flanges
B. Spider bearings D. None of the above
223. A continuous supply of _____ lubricates the drive shaft as it proceeds downward through the oil tube.
- A. Grease C. Water
B. Oil D. None of the above
224. A small hole located at the top of the _____ allows excess oil to enter the well. This results in the formation of an oil film on the water surface within oil-lubricated wells.
- A. Pump bow unit C. Column pipe
B. Drive shaft D. None of the above
225. Often an electric motor that is connected to the _____ by a keyway and nut.
- A. Drive shaft C. Sprocket
B. Rotor D. None of the above
226. Where electricity is not readily available, fuel powered engines may be connected to the drive shaft by a?
- A. Gear C. Right angle drive gear
B. Drive shaft D. None of the above
227. Oil and water lubricated systems will have a strainer attached to the _____ to prevent sediment from entering the pump.
- A. Intake C. Inboard
B. Diaphragm D. None of the above

228. Time delays or ratchet assemblies are often installed on these motors to either prevent the motor from turning on before _____ stops or simply not allow it to reverse at all.
- A. Reverse rotation
 - B. Keyway and nut
 - C. Time delay or ratchet assembly
 - D. None of the above

Safety Section

Definitions

Confined space:

229. A confined space is large enough or so configured that an employee can _____.

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

230. A confined space has limited or restricted means for _____.

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

231. A confined space is not designed for _____.

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

232. A permit required confined space (permit space) contains or has a potential to contain a _____.

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

233. A permit required confined space (permit space) contains a material that has _____.

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

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

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

235. A permit required confined space (permit space) contains any other recognized serious safety or _____.

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

236. Each _____ must be marked "Confined Space - Entry Permit Required".

- A. Permit-Required Confined Space
- B. Hazardous atmosphere
- C. Entry or exit
- D. None of the above

Confined Space Hazards

237. Fatalities and injuries constantly occur among construction workers who are required to enter _____.

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

238. Workers encounter both inherent and _____ within confined workspaces.

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

Inherent Hazards

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

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

240. Inherent hazards include high voltage, radiation generated by equipment, _____, omission of protective features, high or low temperatures, high noise levels, and high-pressure vessels and lines.

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

241. Inherent hazards usually cannot be eliminated without degrading or shutting down the system or equipment. Therefore, emphasis must be placed on _____.

- A. Hazard control methods
- B. Hazardous atmospheres
- C. Continuous employee occupancy
- D. None of the above

Unusual Conditions

Confined Space within a Confined Space

242. The _____ associated with the outer confined space and those of the inner confined space both require testing, monitoring, and control.

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

Hazards in One Space Entering another Space

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

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

Permit Required Confined Space Entry General Rules

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

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

Irritant (Corrosive) Atmospheres

245. According to the text, irritant or corrosive atmospheres can be _____.

- A. Primary irritants
- B. Combustible gases
- C. Divided into primary and secondary groups
- D. None of the above

Asphyxiating Atmospheres

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

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

247. Oxygen is consumed during _____, as in welding, heating, cutting, and brazing.

- A. Oxygen deprivation
- B. Oxygen by nitrogen
- C. Combustion of flammable substances
- D. None of the above

Oxygen Deprivation

248. Nausea, vomiting, _____, and unconsciousness are the physiological effects that occur when oxygen level is between 6-10%. Less than 6%, the effects are spasmodic breathing, convulsive movements, and death in minutes.

- A. Oxygen deprivation
- B. Problems
- C. Inability to perform
- D. None of the above

Competent Person

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

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

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

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

251. Everyone is required to practice _____ one a year.

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

Competent Person Duties

252. The competent person performs daily inspections of the protective equipment, _____, safety equipment, and adjacent areas.

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

253. The competent person shall make _____ prior to the start of work and as needed throughout the shift.

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

254. The competent person shall make _____ after every rainstorm or other hazard occurrence.

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

255. The competent person must have knowledge of _____, telephone or radio dispatch.

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

256. The competent person removes employees and _____ from hazardous conditions and makes all changes necessary to ensure their safety.

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

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

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

Scope of Work

258. Prior to opening an excavation, the estimated locations of _____ that reasonably may be expected to be encountered during excavation work shall be determined.

- A. Unauthorized persons
- B. Employees
- C. Underground utility installations
- D. None of the above

259. _____ shall be taken to protect employees against the hazards posed by water accumulation in the excavation.

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

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

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

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

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

262. The air shall be tested in excavations where _____ exist, or could be reasonably expected to exist.

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

263. When the atmosphere contains less than 19.5 percent oxygen, the area must be continuously ventilated until the _____.

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

264. Where a _____, the area shall be ventilated until the flammable gas concentration is below 20 percent of the LFL (lower flammable limit).

- A. Competent person requires monitoring
- B. Gaseous condition exists
- C. Worker encounters fumes
- D. None of the above

265. Whenever _____ exist or could reasonably exist, the air must be monitored continuously to assure that workers are protected.

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

266. In situations where sidewalks, pavement and appurtenant structures may be undermined, a support system such as shoring must be provided to protect _____ from the possible collapse of such structures.

- A. Unauthorized persons
- B. Employees
- C. Vehicles
- D. None of the above

Personnel Protective Systems

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

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

Excavation Protection Systems

268. There are three basic protective systems for excavations and trenches. They are sloping and benching systems, _____, and shields.

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

269. Every employee in an excavation or trench shall be protected from _____ by an adequate protective system.

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

Sloping and Benching Systems

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

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

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

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

272. Another option for sloping is to utilize _____ prepared by a registered professional engineer.

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

273. According to the text, a registered professional engineer can design a _____ for a specific job.

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

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

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

275. A registered professional engineer must design and stamp the sloping and benching systems for excavations _____.
- A. Greater than twenty (20) feet deep
 - B. In traffic areas
 - C. To be made by contractors
 - D. None of the above

Shield Systems (Trench Boxes)

276. Shielding is the third method of providing a safe workplace in excavations. Unlike sloping and shoring, _____ does not prevent a cave-in.
- A. Shielding
 - B. Tabulated data
 - C. Soil testing
 - D. None of the above

Safety Precautions for Shield Systems

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

278. To protect employees from cave-ins when entering and exiting the shield, a ladder within the _____ or a properly sloped ramp at the end shall be provided.
- A. Shield
 - B. Jobsite
 - C. Tabulated data
 - D. None of the above

279. According to the text, employees are not allowed in the _____ during installation, removal, or during any vertical movement.
- A. Sloping and benching systems
 - B. Shield
 - C. Vicinity of the excavation
 - D. None of the above

280. Shields can be installed 2 ft. above the bottom of an excavation, provided that they are designed to _____.
- A. Tabulated data
 - B. Resist loads at the full depth
 - C. Be easily removed
 - D. None of the above

281. The exposed excavation wall at the _____ must be sloped, shored, or shielded.
- A. Excavation site
 - B. Open end of the shield
 - C. Traffic side of the excavation
 - D. None of the above

Personal Protective Equipment

282. _____ requires that employees wear a hard hat, safety glasses, and work boots on the jobsite.
- A. The contractor
 - B. OSHA policy
 - C. Recommended practice
 - D. None of the above

Excavation & Trenching Guidelines

283. Procedures and guidelines for the protection of employees working in and around excavations and trenches must be in compliance with OSHA Standards described in Subpart P (CFR 1926.650) for the construction industry.
- A. True
 - B. False

284. According to the text, the competent person(s) must be trained in accordance with the OSHA Excavation Standard, and all other programs that may apply, and must demonstrate a thorough understanding and knowledge of the programs and the hazards associated.
- A. True
 - B. False

Hazard Controls

285. Knowing the location of underground installations is a good idea because it could make the work go faster.

- A. True B. False

286. An excavation safety plan must be developed to protect employees.

- A. True B. False

287. All overhead hazards (surface encumbrances) must be removed or supported to _____.

- A. Meet OSHA Standards C. Eliminate the hazard
B. Make trenching and excavating easier D. None of the above

288. If _____ will be over 20 feet deep, it must be designed by a registered professional engineer.

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

289. _____, such as sloping, shoring, or shielding, will be utilized to protect employees.

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

290. Workers must be supplied with, and wear, any _____ deemed necessary to protect them while working in excavations.

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

291. All _____ must be stored at least two (2) feet from the sides of the excavation. The spoil pile must not block the safe means of egress.

- A. Safety plans C. Spoil piles
B. Barricades D. None of the above

292. If a trench or excavation is 4 feet or deeper, stairways, ramps, or ladders must be provided as a safe means of access and egress. Employees working in trenches must not have to travel any more than 25 feet laterally to reach a _____.

- A. Stairway, ramp, or ladder C. Benched area
B. Safe area D. None of the above

293. No employee will be permitted to work in an excavation where _____ is accumulating unless adequate protection measures are used to protect the employees.

- A. Construction debris C. Spoil
B. Water D. None of the above

294. All excavations and trenches must be inspected daily by a _____, prior to employee exposure or entry. Trenches and excavations will also be inspected after any rainfall, soil change, or any other time needed during the shift.

- A. Professional engineer C. Competent person
B. Supervisor D. None of the above

295. When excavations and trenches 4 feet or deeper have the potential for toxic substances or _____, the air will be tested at least daily.

- A. Cave-ins C. Hazardous atmospheres
B. Unauthorized workers D. None of the above

296. If work is in or around traffic, _____ must be utilized to ensure the safety of employees, vehicular traffic, and pedestrians.

- A. Signs and barricades
- B. Soil classifications
- C. Additional personnel
- D. None of the above

Excavation Safety Plan

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

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

Soil Classification and Identification

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

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

Soil Test & Identification

299. The competent person will classify the _____ according to the definitions in Appendix A of the OSHA standard based on at least one visual and one manual analysis.

- A. Shields
- B. Soil type
- C. Cohesion tests
- D. None of the above

Shielding

300. When placed in an excavation, shields have sufficient structural strength to support the _____, thereby protecting the employees in the trench.

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

Water Quality Section

Three Types of Public Water Systems

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

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

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

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

303. Approximately 18,000 water systems

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

Managing Water Quality at the Source

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

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

Physical Characteristics of Water

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

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

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

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

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

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

308. _____ is a substance that can give up a hydrogen ion (H^+); a base is a substance that can accept H^+ .

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

309. The more acidic a solution the greater the hydrogen ion concentration and the lower the pH; a pH of 7.0 indicates neutrality, a pH of less than 7 indicates acidity, and a pH of more than 7 indicates _____.

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

pH Testing Section

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

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

311. Pure water has a pH very close to?

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

What are Disinfection Byproducts (DBPs)?

312. Which of the following form when disinfectants used to treat drinking water react with naturally occurring materials in the water?

- A. Chloramines
- B. Humic and fulvic acids
- C. Disinfection byproducts (DBPs)
- D. None of the above

313. Total trihalomethanes and haloacetic acids are widely occurring _____ formed during disinfection with chlorine and chloramine.

- A. Gases
- B. Substances
- C. Classes of DBPs
- D. None of the above

Are THMs and HAAs the only disinfection byproducts?

314. The presence of TTHM and HAA5 is representative of the occurrence of many other chlorination DBPs; thus, an increase of TTHM and HAA5 generally indicates an increase of DBPs from chlorination.

- A. True
- B. False

All disinfectants form DBPs in one of two reactions:

315. Chlorine and chlorine-based compounds (halogens) react with organics in water causing the hydrogen atom to substitute other atoms, resulting in halogenated by-products.
A. True B. False

316. Secondary by-products are formed when multiple disinfectants are used.
A. True B. False

Public Health Concerns

317. Results from toxicology studies have shown several DBPs (e.g., bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate) to be inert to laboratory animals.
A. True B. False

318. Other DBPs (e.g., chlorite, bromodichloromethane, and certain haloacetic acids) have also been shown to cause adverse mutations (extra chromosomes) in laboratory animals.
A. True B. False

Disinfection Byproduct Research and Regulations Summary

319. _____ is unquestionably the most important step in the treatment of water for drinking water supplies.
A. DBP(s) C. Disinfection
B. Turbidity (particle) D. None of the above

320. The _____ should not be compromised because of concern over the potential long-term effects of disinfectants and DBPs.
A. DBP(s) C. Microbial quality of drinking water
B. Turbidity (particle) D. None of the above

Bacteriological Monitoring Section

TCR

321. The TCR recommends most of the Public Water Systems (PWS) to monitor their distribution system for bacteria according to the written sample sitting plan for that system.
A. True B. False

322. The sample sitting plan identifies sampling frequency and locations throughout the distribution system that are selected to be representative of conditions in the entire system.
A. True B. False

323. Coliform contamination may occur anywhere in the system, possibly due to problems such as; high-pressure conditions, line fluctuations, or wells, and therefore routine monitoring is required.
A. True B. False

Routine Sampling Requirements

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

325. For PWSs collecting more than one sample per month, collect total coliform samples at regular intervals throughout the month, except that ground water systems serving 4,900 or fewer people may collect all required samples on a single day if the samples are taken from different sites.

- A. True B. False

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

- A. True B. False

327. If any TC+ sample is also E. coli-positive (EC+), then the EC+ sample result must be reported to the state by the end of the month that the PWS is notified.

- A. True B. False

328. If any routine sample is TC+, repeat samples are required. – PWSs on quarterly or annual monitoring must take a minimum of one additional routine samples (known as additional routine monitoring) the quarter following a TC+ routine or repeat sample.

- A. True B. False

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

- A. True B. False

Dangerous Waterborne Microbes

330. Which of the following are bacteria whose presence indicates that the water may be contaminated with human or animal wastes? Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms.

- A. Fecal Coliform and E. coli C. Shigella dysenteriae
B. Cryptosporidium D. None of the above

Bacteriological Monitoring Introduction

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

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

The three (3) primary types of samples are:

332. Samples collected following a coliform present routine sample. The number of repeat samples to be collected is based on the number of _____ samples you normally collect.

- A. Repeat C. Routine
B. Special D. None of the above

333. A PWS fails to take every required repeat sample after any single TC+ sample

- A. Trigger: Level 1 Assessment C. All of the above
B. Trigger: Level 2 Assessment D. None of the above

334. A PWS incurs an E. coli MCL violation.

- A. Trigger: Level 1 Assessment C. All of the above
B. Trigger: Level 2 Assessment D. None of the above

Disinfection Key

335. The RTCR requires 99.99% or 4 log inactivation of _____ .

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

336. The RTCR requires 99% or 2 log inactivation of _____ .
- A. Enteric viruses
 - B. Crypto
 - C. Giardia lamblia cysts
 - D. None of the above

Advanced Water Treatment Section

337. Water contains _____ of which impart a quality known as hardness?
- A. TDS
 - B. Conductivity
 - C. Various amounts of dissolved minerals
 - D. None of the above

Occurrence of Hard Water

338. Which of the following is caused by soluble, divalent, metallic cations, (positive ions having valence of 2)?
- A. Hard water
 - B. Permanent hardness
 - C. Carbonate hardness
 - D. None of the above

Types of Hardness

339. Hardness can be categorized by either of two methods: calcium versus magnesium hardness and?
- A. Carbonate hardness
 - B. Temporary hardness
 - C. Carbonate versus non-carbonate hardness
 - D. None of the above

Carbonate-Noncarbonate Distinction

340. According to the text, the carbonate-noncarbonate distinction, is based on hardness from either the bicarbonate salts of calcium or the _____ involved in causing water hardness.
- A. CaCO_3
 - B. Water hardness
 - C. Normal salts of calcium and magnesium
 - D. None of the above

Nanofiltration (NF) Section

341. Nanofiltration is a relatively recent membrane filtration process used most often with low total dissolved solids water with the purpose of softening (polyvalent cation removal) and removal of _____ such as natural organic matter and synthetic organic matter.
- A. Process liquid
 - B. Chloride and sodium
 - C. Disinfection by-product precursors
 - D. None of the above

342. Nanofiltration is also becoming more widely used in food processing applications and for _____ and partial (monovalent ion) demineralization.
- A. Process liquid
 - B. Simultaneous concentration
 - C. Natural organic matter and synthetic organic matter
 - D. None of the above

Reverse Osmosis Process Section

343. Which of the following is determined by the total dissolved solids content of the saline solution, or contaminated solution on one side of the membrane?
- A. This pressure differential
 - B. Osmotic pressure
 - C. Higher molecular weights
 - D. None of the above
344. The higher the content of dissolved solids, the higher the?
- A. This pressure differential
 - B. Osmotic pressure
 - C. Higher molecular weights
 - D. None of the above
345. According to the text, common tap water as found in most areas may have an osmotic pressure of about 10 PSI (Pounds per Square Inch), or about?
- A. 36,000 PPM
 - B. 376 PSI
 - C. 1.68 Bar
 - D. None of the above

346. To reach the point at which osmosis stops for tap water, a pressure of 10 PSI would have to be applied to the saline solution, and to stop osmosis in seawater, a pressure of _____ would have to be applied to the seawater side of the membrane.

- A. 36,000 PPM
- B. 376 PSI
- C. 1.68 Bar
- D. None of the above

Brine Channel

347. Concentrated raw water is called the reject stream or concentrate stream, it may also be called brine if it is coming from a?

- A. Salt water source
- B. Concentrations of TDS
- C. Amount of permeate or product water
- D. None of the above

348. Which of the following when sufficient flows are maintained, serves to carry away the impurities removed by the membrane, thus keeping the membrane surface clean and functional?

- A. Pressure differential
- B. Waste (concentrate)
- C. The concentrate
- D. None of the above

349. The membrane material itself is a special thin film composite (TFC) polyamide material, cast in a microscopically thin layer on another, thicker cast layer of Polysulfone called?

- A. Membrane material
- B. Microporous support layer
- C. Spiral wound element design
- D. None of the above

350. To achieve Reverse Osmosis, the _____ pressure is generally doubled.

- A. Concentration
- B. Osmotic
- C. Amount of permeate or product water
- D. None of the above

351. The inverse occurs with lower temperatures, in that salt passage decreases (reducing the _____ in the permeate or product water), while operating pressures increase. Or, if operating pressures do not increase, then the amount of permeate or product water is reduced.

- A. TDS
- B. Raw water
- C. Salt
- D. None of the above

352. The rejection rate is the percentage of _____ rejected, or prevented from passing through the membrane.

- A. Brackish water
- B. Raw water
- C. Dissolved solids
- D. None of the above

353. As the raw water is processed, the concentrations of _____ increase as it passes along the membrane's length and usually multiple membranes are employed, with each membrane in series seeing progressively higher dissolved solids levels.

- A. Brackish water
- B. Raw water
- C. TDS
- D. None of the above

Disinfection Section

Chlorine's Appearance and Odor

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

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

355. Prolonged exposures to chlorine gas may result in?

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

Chlorine Gas

Pathophysiology

356. As far as chlorine safety and respiratory protection, the intermediate _____ of chlorine accounts for its effect on the upper airway and the lower respiratory tract.

- A. Effects of Hydrochloric acid
- B. Vapor from Chlorine gas
- C. Water solubility
- D. None of the above

357. Respiratory exposure to _____ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.

- A. Hydrochloric acid
- B. Chlorine gas
- C. Plasma exudation
- D. None of the above

358. The odor threshold for chlorine gas is approximately?

- A. 0.3-0.5 parts per million (ppm)
- B. 3 parts per million (ppm)
- C. 3-5 parts per million (ppm)
- D. None of the above

Mechanism of Activity

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

- A. True
- B. False

Early Response to Chlorine Gas

360. If you mix ammonia with chlorine gas, this compound reacts to form _____.

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

Reactivity

361. Cylinders of chlorine may burst when exposed to elevated temperatures. When there is Chlorine in solution, this forms?

- A. Hydrogen sulfide
- B. Oxomonosilane
- C. A corrosive material
- D. None of the above

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

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

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

- A. True
- B. False

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

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

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

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

Flammability

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

- A. True B. False

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

- A. True B. False

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

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

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

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

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

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

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

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

372. Chlorination is more effective as?

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

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

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

374. Chlorination is less effective in?

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

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

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

Chlorination Chemistry

376. 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 C. "CT" disinfection concept
B. Ratio of hypochlorous acid D. None of the above

377. Although the ratio of _____ is greater at lower temperatures, pathogenic organisms are actually harder to kill.

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

378. If all other things were equal, _____ and a lower pH are more conducive to chlorine disinfection.

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

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. True
- B. False

Chlorine DDBP

383. These term means that chlorine is present as Cl, HOCl, and OCl^- is called _____, and that which is bound but still effective is _____.

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

384. Chloramines are formed by reactions with?

- A. Acid and Cl_2
- B. Ammonia and Cl_2
- C. Folic Acid and Cl_2
- D. None of the above

Types of Residual

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

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

Chlorine Exposure Limits

386. What is OSHA's PEL?

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

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

- A. True
- B. False

388. Liquid chlorine is about _____ times heavier than water

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

389. Gaseous chlorine is about _____ times heavier than air.

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

Alternate Disinfectants - Chloramine

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

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

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

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

Chlorine Dioxide

392. Which term provides good Giardia and virus protection but its use is limited by the restriction on the maximum residual of 0.5 mg/L ClO₂/chlorite/chlorate allowed in finished water?

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

393. If chlorine dioxide is being used as an oxidant, the preferred method of generation is to entrain or _____ into a packed reaction chamber with a 25% aqueous solution of sodium chlorite (NaClO₂).

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

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

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

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

- A. True
- B. False

Ozone

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

- A. True
- B. False

397. Ozone does not produce chlorinated byproducts (such as trihalomethanes) but it may cause an increase in such byproduct formation if it is fed ahead of free chlorine; ozone may also produce its own oxygenated byproducts such as Cl₂ + NH₄.

- A. True
- B. False

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

- A. True
- B. False

399. When determining Ozone CT (contact time) values must be determined for the ozone basin alone; an accurate _____ must be obtained for the contact chamber, and residual levels.
A. Residual C. Contact time
B. T10 value D. None of the above

400. Ozone does not provide a system residual and should be used as a primary disinfectant only in conjunction with?
A. Dry sodium chlorite C. Free and/or combined chlorine
B. Chlorine dioxide D. None of the above