

Registration form

**WELLFIELD OPERATOR \$200.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

Start and Finish Dates: _____

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

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

Name _____ **Signature** _____

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

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Operator ID # _____ **Exp. Date** _____

Class/Grade _____

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

Water Distribution ___ Pump Installer ___ Other _____

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

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

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.tlch2o.com/downloads/PDF/CEU%20State%20Approvals.pdf>

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

AFFIDAVIT OF EXAM COMPLETION

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

Grading Information

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

Rush Grading Service

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

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

Wellfield Operator 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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I understand that I am 100 percent responsible to ensure that TLC receives the Assignment and Registration Key. I understand that TLC has a zero tolerance towards not following their rules, cheating or hostility towards staff or instructors. I need to complete the entire assignment for credit. There is no credit for partial assignment completion. My exam was proctored.

I will contact TLC if I do not hear back from them within 2 days of assignment submission. I will forfeit my purchase costs and will not receive credit or a refund if I do not abide with TLC's rules.

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

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

**WELLFIELD OPERATOR CEU COURSE
CUSTOMER SERVICE RESPONSE CARD**

NAME: _____

E-MAIL _____ PHONE _____

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

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

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

Very Similar 0 1 2 3 4 5 Very Different

How did you hear about this Course? _____

What would you do to improve the Course?

Any other concerns or comments.

**Please fax the answer key to TLC Western Campus
Fax (928) 272-0747**

Always call us after faxing the paperwork to ensure that we've received it.

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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 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.

Wellfield Operator CEU Training Course Assignment

The Wellfield Operator 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>

Safety Section

Confined Space Entry Program

Purpose

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

- A. True B. False

Scope

2. According to the text, you are required to recognize _____ associated with confined spaces.

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

Definitions

Confined space:

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

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

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

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

5. A confined space is not designed for _____.

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

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

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

7. A permit required confined space (permit space) contains a material that has _____.
- A. Authorized entrants C. The potential for engulfing an entrant
 B. Hazardous atmospheres D. None of the above
8. A permit required confined space (permit space) has an internal configuration such that _____ could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- A. An entrant C. An internal configuration
 B. Hazardous atmosphere D. None of the above
9. A permit required confined space (permit space) contains any other recognized serious safety or _____.
- A. Engulfing an entrant C. Health hazard
 B. Hazardous atmospheres D. None of the above
10. Each _____ must be marked "Confined Space - Entry Permit Required".
- A. Permit-Required Confined Space C. Entry or exit
 B. Hazardous atmosphere D. None of the above

Induced Hazards

11. _____ result from a multitude of incorrect decisions and actions that occur during the actual construction process.
- A. Induced hazards C. Build-up of explosive gases
 B. Below-grade locations D. None of the above

Oxygen-Deficient Atmosphere

12. The ever-present possibility of _____ is one of the major problems confronting construction workers while working in vaults.
- A. A common confined space C. An oxygen-deficient atmosphere
 B. Vaults D. None of the above

Explosive or Toxic Gases, Vapors, or Fumes

13. _____ produce toxic fumes that are confined in the limited atmosphere of a confined space.
- A. Purging agents C. Welding and soldering
 B. Below-grade locations D. None of the above

Tanks

14. Tanks are _____ that are used for a variety of purposes, including the storage of water and chemicals.
- A. Nitrogen purge locations C. Another type of confined workspace
 B. Collection places D. None of the above
15. Heat in tanks may cause _____, particularly on a hot day.
- A. Heat prostration C. Problems with pumps
 B. Equipment failure D. None of the above

Unusual Conditions- Confined Space within a Confined Space

16. The _____ associated with the outer confined space and those of the inner confined space both require testing, monitoring, and control.
- A. Potential hazards C. Manholes
 B. Access passages D. None of the above

Asphyxiating Atmospheres

17. 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
18. 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

Carbon Dioxide

19. Since _____ have specific gravities greater than air, these gases may lie in a tank or manhole for hours or days after opening.
- A. Chemical reactions
 - B. Normal atmospheres
 - C. Carbon dioxide and argon
 - D. None of the above

Oxygen Deprivation

20. Oxygen deprivation is a form of _____.
- A. Oxygen deprivation
 - B. Asphyxiation
 - C. Combustion
 - D. None of the above

Excavation and Trenching Section

21. According to the text, the _____ was revised because excavating is the most dangerous of all construction operations.
- A. Competent rule
 - B. OSHA excavation standard
 - C. Emergency rule
 - D. None of the above
22. OSHA also revised the _____ to clarify the requirements.
- A. Competent rule
 - B. Existing standard
 - C. Protective equipment standard
 - D. None of the above
23. The performance criteria in the new standard provides employers with options when classifying soil and when selecting methods to protect the _____ from cave-ins.
- A. Competent person
 - B. Employee
 - C. Construction equipment
 - D. None of the above
24. Although employers have options when meeting some of the requirements, _____ must realize that the employee must be protected at all times.
- A. Competent persons
 - B. Employers
 - C. Contractors
 - D. None of the above

Competent Person

25. 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

26. 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 C. Watchman
B. Contractor D. None of the above

27. Everyone is required to practice _____ one a year.
A. Competent person training C. Emergency procedures
B. Rescue training exercises D. None of the above

Competent Person Duties

28. The competent person performs daily inspections of the protective equipment, _____, safety equipment, and adjacent areas.
A. Work progress C. Trench conditions
B. Construction Crew D. None of the above

29. The competent person shall make _____ prior to the start of work and as needed throughout the shift.
A. Personnel assignments C. Inspections
B. Training available D. None of the above

30. The competent person shall make _____ after every rainstorm or other hazard occurrence.
A. Inspections C. Protective equipment available
B. Training available D. None of the above

31. The competent person must have knowledge of _____, telephone or radio dispatch.
A. Personnel assignments C. Emergency contact methods
B. Work schedules D. None of the above

32. The competent person removes employees and _____ from hazardous conditions and makes all changes necessary to ensure their safety.
A. Competent persons C. Protective equipment
B. All other personnel D. None of the above

33. 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 C. Employees
B. Contractors D. None of the above

Scope of Work

34. According to the text, during excavation work a competent person shall be on the job site at all times when personnel are working within or around the _____.
A. Competent person C. Excavation
B. Contractors D. None of the above

35. In trench excavations that are four (4') feet or more in depth, a stairway, ladder, or ramp shall be used as a _____.
A. Tool C. Bridge
B. Means of access or egress D. None of the above

36. When excavations are made in vehicular traffic areas, _____ shall wear a warning vest made with reflective material or highly visibility material.
A. Competent persons C. Rescue personnel
B. Each employee D. None of the above

37. The air shall be tested in excavations where _____ exist, or could be reasonably expected to exist.
A. Limited visibilities C. Oxygen deficiency or gaseous conditions
B. Employees D. None of the above

38. When the atmosphere contains less than 19.5 percent oxygen, the area must be continuously ventilated until the _____.
A. Excavation is closed C. Oxygen levels are above 19.5 percent
B. Employees enter the space D. None of the above

39. In situations where sidewalks, pavement and appurtenant structures may be undermined, a support system such as shoring must be provided to protect _____ from the possible collapse of such structures.
A. Unauthorized persons C. Vehicles
B. Employees D. None of the above

Personnel Protective Systems

40. 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 C. Protective systems
B. Vehicles D. None of the above

Excavation Protection Systems

41. There are three basic protective systems for excavations and trenches. They are sloping and benching systems, _____, and shields.
A. Shoring C. Attendants
B. Ramps D. None of the above

42. Every employee in an excavation or trench shall be protected from _____ by an adequate protective system.
A. Unauthorized persons C. Polluted air
B. Cave-ins D. None of the above

Sloping and Benching Systems

43. 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 C. Porous soil type
B. Stable soil type D. None of the above

44. Another option for sloping is to utilize _____ prepared by a registered professional engineer.
A. Instructions C. Standards
B. Tabulated data D. None of the above

45. According to the text, a registered professional engineer can design a _____ for a specific job.
A. Table C. Protective system
B. Sloping plan D. None of the above

46. _____ 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

Shoring Systems

47. _____ is another protective system that utilizes a framework of vertical members, horizontal members, and cross braces to support the sides of the excavation to prevent a cave-in.
- A. Shoring
 - B. Tabulated data
 - C. Lateral support
 - D. None of the above

Shield Systems (Trench Boxes)

48. 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

49. Shields are designed to _____, thereby protecting the employees working inside the structure.
- A. Withstand the soil forces caused by a cave-in
 - B. Keep water out of the excavation
 - C. Bend but not break
 - D. None of the above

50. Design and construction of _____ is not covered in the OSHA Standards.
- A. Sloping and benching systems
 - B. Shielding
 - C. Protective systems
 - D. None of the above

Safety Precautions for Shield Systems

51. There must not be any lateral movement of _____ when installed.
- A. Sloping and benching systems
 - B. Shields
 - C. Ladders
 - D. None of the above
52. 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
53. 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
54. 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
55. 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

56. _____ 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

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

Hazard Controls

58. All overhead hazards (surface encumbrances) must be removed or supported to _____.
- A. Meet OSHA Standards
 - B. Make trenching and excavating easier
 - C. Eliminate the hazard
 - D. None of the above
59. 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
 - B. Barricades
 - C. Spoil piles
 - D. None of the above
60. 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.
- A. 5
 - B. 4
 - C. 6
 - D. None of the above
61. Employees working in trenches must not have to travel any more than 25 feet laterally to reach a _____.
- A. Stairway, ramp, or ladder
 - B. Safe area
 - C. Benched area
 - D. None of the above
62. 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
 - B. Water
 - C. Spoil
 - D. None of the above
63. 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
 - B. Supervisor
 - C. Competent person
 - D. None of the above
64. 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
 - B. Unauthorized workers
 - C. Hazardous atmospheres
 - D. None of the above
65. 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

66. 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 C. Protective systems
B. OSHA Excavation Safety Standard D. None of the above

Soil Classification and Identification

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

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

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

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

69. Examples of Type A soils are _____ like caliche and hardpan.

- A. Cemented soils C. Uncommon soils
B. Soil classifications D. None of the above

Soil Test & Identification

70. 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 C. Cohesion tests
B. Soil type D. None of the above

71. Clay, silt, and sand are _____. Clay particles are the smallest, silt particles are intermediate, and sand particles are the largest.

- A. Very cohesive C. Size classifications
B. Corrosive D. None of the above

72. The degree of _____ and plasticity of a soil depend on the amounts of clay, silt, sand, and water present.

- A. Compatibility C. Durability
B. Cohesiveness D. None of the above

73. The soil in an excavation is subject to change several times within the scope of a project and the _____ will vary with weather and job conditions.

- A. Shields C. Moisture content
B. Shoring D. None of the above

74. According to the text, the competent person must also determine the level of protection based on what conditions exist at the time of the test, and _____.

- A. Available equipment C. Allow for changing conditions
B. Tabulated data D. None of the above

Shielding

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

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

76. Most _____ have two flat, parallel metal walls which are held apart by metal cross braces which are placed at the ends of the "box." This allows for the installation of pipe within the interior dimensions of the shield.
- A. Shields
B. Reputable manufacturers
C. Shoring systems
D. None of the above
77. An operation where a contractor excavates just enough trench to install the shield, then sets a joint of pipe, then excavates further, then pulls the shield forward to install another joint while the first is being backfilled, is known as "_____".
- A. Shielding
B. Cut and cover
C. Standard practice
D. None of the above
78. _____ have become more popular with public works maintenance crews and contractors working in shallow excavations because of their ease of use.
- A. Smaller shields
B. Reputable manufacturers
C. Open-ended shields
D. None of the above
79. Round shields made of _____ have recently appeared.
- A. Approved materials
B. Wood
C. Corrugated metal
D. None of the above
80. Since shield construction is not covered by OSHA Standards, it is critical that you know your _____.
- A. Supplier
B. Safety manual
C. Competent person
D. None of the above
81. _____ supply boxes designed by registered professional engineers and certified for their applications.
- A. Contractor's
B. Reputable manufacturers
C. Local
D. None of the above
82. Any modification to the shields must be _____.
- A. Reported to the competent person
B. Noted in the excavation log
C. Approved by the manufacturer
D. None of the above
83. Shields in trenches must be installed so as to prevent _____ in the event of a cave-in
- A. Lateral movement
B. Damage to equipment
C. Cohesion tests
D. None of the above
84. According to the text, shields may ride two feet above the bottom of an excavation, provided they are calculated to support the full depth of the excavation and there is no _____ under or behind the shield.
- A. Caving
B. Material
C. Spoil
D. None of the above
85. Workers must be protected when entering or leaving the shield by using a _____ within the shield or a properly sloped ramp at the end.
- A. Shield
B. Ladder
C. Support
D. None of the above

86. Workers must exit the shield during its installation, removal, or _____.
- A. Inclement weather
 - B. Soil testing
 - C. During vertical movement
 - D. None of the above
87. The excavation wall at the _____ should be sloped, shored or shielded off to prevent a cave-in from the end.
- A. Side of the shield
 - B. End of the job
 - C. Open end of the shield
 - D. None of the above
88. If the excavation will be deeper than the _____, attached shields of the correct specifications may be used. As an alternate, the excavation may be sloped back to the maximum allowable angle from a point 18 inches below the top of the shield.
- A. Planned depth
 - B. Shield is tall
 - C. Designed depth
 - D. None of the above

Inspections

89. The excavations, adjacent areas, and protective systems shall be inspected daily by the _____.
- A. Contractor
 - B. Employees
 - C. Competent person
 - D. None of the above
90. During inspections, the competent person shall look for evidence of a situation that could result in a cave-in, indications of _____, hazardous atmospheres or other hazardous conditions.
- A. Failure of protective systems
 - B. Poor workmanship
 - C. OSHA compliance
 - D. None of the above

Groundwater Treatment/Production System Section

Groundwater and Wells

91. When toxic substances are spilled or dumped near a well, these can leach into _____ and contaminate the groundwater drawn from that well.
- A. Karst
 - B. Aquifer
 - C. Soil moisture
 - D. None of the above
92. Which of the following flows slowly through water-bearing formations at different rates?
- A. Groundwater
 - B. Drinking water
 - C. Soil moisture
 - D. None of the above
93. The level below which all the spaces in the ground are filled with water is called the?
- A. Unconfined aquifer(s)
 - B. Water table
 - C. Well(s)
 - D. None of the above
94. The area above the water table lies the?
- A. Unsaturated zone
 - B. Karst
 - C. Saturated zone
 - D. None of the above
95. The water in the saturated zone is called?
- A. Unconfined aquifer(s)
 - B. Groundwater
 - C. Water table
 - D. None of the above

96. 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
97. 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
98. 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
99. 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
100. 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) C. Fractured aquifer(s)
B. Porous media D. None of the above
101. Which of the following usually flows downhill along the slope of the water table?
- A. Groundwater C. Soil moisture
B. Water table D. None of the above

Cone of Depression

102. During pumping, the water level in the well falls below the water table in the?
- A. Water table C. Unconfined aquifer
B. Surrounding aquifer D. None of the above
103. The movement of water from _____ into a well results in the formation of a cone of depression.
- A. Confined aquifer C. Water table
B. An aquifer D. None of the above
104. Which of the following describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?
- A. Water table C. Cone of depression
B. Groundwater D. None of the above
105. Which of the following is the vertical drop in the height between the water level in the well prior to pumping and the water level in the well during pumping?
- A. Drawdown C. Cone of depression
B. Groundwater D. None of the above
106. When a water well is installed in _____, water moves from the aquifer into the well through small holes or slits in the well casing or, in some types of wells, through the open bottom of the well?
- A. Confined aquifer C. Water table
B. An unconfined aquifer D. None of the above

Where Is Ground Water Stored?

107. 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

108. Which of the following stores water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?

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

109. Which of the following is regulated largely by its porosity, or the relative amount of open space present to hold water?

- A. Water table
- B. Groundwater
- C. An aquifer's storage capacity
- D. None of the above

110. If the aquifer is sandwiched between layers of comparatively impermeable materials, it is called?

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

111. Which of the following are frequently found at greater depths than unconfined aquifers?

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

Does Groundwater Move?

112. Groundwater can move sideways as well as up or down. This movement is in response to gravity, differences in elevation, and?

- A. Permeable zones
- B. Differences in pressure
- C. Saturated zone
- D. None of the above

113. Groundwater can move even more quickly in karst aquifers, which are areas in _____ and similar rocks where fractures or cracks have been widened by the action of the ground water to form sinkholes, tunnels, or even caves?

- A. Karst aquifer(s)
- B. Saturated zone
- C. Water soluble limestone
- D. None of the above

Groundwater Quality

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

- A. True
- B. False

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

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

How Does Ground Water Become Contaminated?

116. Groundwater contamination can begin on the surface of the ground, in the ground above the water table, or in the ground below the?

- A. Water table
- B. Ground water
- C. Permeable zones
- D. None of the above

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

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

118. Substances that can pollute _____ can be divided into two basic categories: substances that occur naturally and substances produced or introduced by man's activities.

- A. Synthetic organic chemical(s)
- B. Groundwater
- C. Permeable zones
- D. None of the above

119. 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

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

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

Water Well Reports and Hydrogeology

Hydrogeologic Data

121. 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

Nature of the Aquifer

122. 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

123. 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

124. 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)

125. 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

126. 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)

127. 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

128. 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?

129. 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

130. 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?

131. 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

132. 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

133. 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

134. 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

135. 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

136. 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

Basic Rotary Drilling Methods

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

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

The Rotary Drill String

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

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

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

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

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

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

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

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

142. 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
- B. A Sub
- C. A kelly
- D. None of the above

143. 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. Shock absorber
- D. None of the above

144. 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

145. 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

146. 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

147. 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

148. 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

149. 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

150. 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

151. 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

152. 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

153. 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

154. 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

155. 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

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

156. 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

157. 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

Air Rotary Method

158. 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

159. 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

160. 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

161. 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

162. _____ 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

163. 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

164. 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

165. 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

166. 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

167. 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

168. 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

169. 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

170. 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

171. 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

172. 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

173. 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

174. 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

175. 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

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

176. 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

177. 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?

178. 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

179. 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

180. 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

181. 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

182. 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

183. 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

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

Pump and Motor Section

Common Hydraulic Terms

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

General Pumping Fundamentals

191. According to the text, suction lift is when the level of water to be pumped is below the?
- A. Impeller C. Centerline of the pump
B. Suction D. None of the above

Pumps

192. Pumps are excellent examples of?
- A. Hydrostatics C. Multi-stage pumps
B. Quasi-static devices 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 C. Passage in one direction
B. Diaphragms 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

Basic Water Pump

198. 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

199. 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

200. 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

201. 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):

202. 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. Higher pressure
- D. None of the above

203. 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

214. 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

215. 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

216. 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

217. 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

218. 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

219. Time delays or ratchet assemblies are often installed on these motors to either prevent the motor from turning on before _____ stops or simply not allow it to reverse at all.

- A. Reverse rotation C. Time delay or ratchet assembly
- B. Keyway and nut D. None of the above

Water Distribution Section

System Elements

220. 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

221. Booster stations are used to _____ from storage tanks for low-pressure mains.

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

Butterfly Valve

222. 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

223. 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

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

- A. Bluestakes
- B. Testing
- C. Repair or replacement
- D. None of the above

Gate Valves

225. If the valve is wide open, the gate inside the valve is _____ into the valve bonnet.

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

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

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

Valve Exercising

227. 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
- B. Lock in the open position
- C. Lock in the closed position
- D. None of the above

Water Pressure

228. 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

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

- A. True
- B. False

230. 20 psi is the minimum pressure required at any point in the water system, so that _____ is prevented.

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

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

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

Water Use or Demand

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

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

233. Which of the following is highly desired and represents a rather significant demand upon the system?

- A. Fire protection
- B. Cavitation protection
- C. Surge protection
- D. None of the above

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

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

Water Storage Introduction

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

Storage and Distribution

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

Water Storage Facilities

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

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

Storage Reservoirs

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

Cross-Connection Section

What is Backflow?

240. Backflow is the undesirable reversal of flow of nonpotable water or other substances through a _____ and into the piping of a public water system or consumer's potable water system.
- A. Backflow
 - B. Indirect connection
 - C. Cross-connection
 - D. None of the above
241. Which of the following can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?
- A. Backsiphonage
 - B. Backpressure
 - C. Cross-connection
 - D. None of the above
242. Which of the following is a type of backflow caused by a downstream pressure that is greater than the upstream or supply pressure in a public water system or consumer's potable water system?
- A. Backflow
 - B. Backpressure
 - C. Indirect connection
 - D. None of the above

243. 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
244. Which of the following can have two forms-backpressure and backsiphonage?
 A. Backflow C. Cross-connection
 B. Backpressure D. None of the above
245. 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
246. 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
247. 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
248. 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
249. 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
250. 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
251. 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

252. 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

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

253. When the _____ is restricted, such as the case of an air gap located near a wall, the air gap separation must be increased.

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

254. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of a(n)?

- A. Open receiving vessel
- B. Air break
- C. Barrier to backflow
- D. None of the above

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

- A. Open receiving vessel
- B. Air break
- C. Air gap
- D. None of the above

256. According to the text, air gap separations must be vertically orientated a distance of at least twice the inside diameter of the supply, but never less than?

- A. 1 inch
- B. 2 inches
- C. 12 inches
- D. None of the above

257. An obstruction around or near an _____ may restrict the flow of air into the outlet pipe and nullify the effectiveness of the air gap to prevent backsiphonage.

- A. Open receiving vessel
- B. Air break
- C. Air gap
- D. None of the above

258. An air gap is acceptable for _____ and is theoretically the most effective protection.

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

Vacuum Breakers

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

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

260. Both vacuum breakers devices are only suitable for?

- A. High hazard installations
- B. High pollutional concerns
- C. Low hazard conditions
- D. None of the above

261. Which of the following may not be installed downstream of atmospheric vacuum breakers but are allowed on pressure vacuum breakers?

- A. Valve assembly
- B. Shut offs
- C. Air inlet valve
- D. None of the above

262. The AVB devices must be installed above the highest?

- A. Downstream piping
- B. Vacuum breakers
- C. Hazard applications
- D. None of the above

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

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

Water Quality Section

Three Types of Public Water Systems

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

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

265. Approximately 85,000 systems

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

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

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

pH Testing Section

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

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

268. Pure water has a pH very close to?

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

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

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

Objections to Hard Water

Scale Formation

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

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

More on the Stage 2 DBP Rule

271. Which of the following rules focuses on public health protection by limiting exposure to DBPs, specifically total trihalomethanes and five haloacetic acids, which can form in water through disinfectants used to control microbial pathogens?

- A. Stage 2 DBP rule C. Long Term 2 Enhanced Surface Water Treatment Rule
- B. Stage 1 DBPR D. None of the above

272. Which of the following is one of the major public health advances in the 20th century?

- A. Disinfection of drinking water C. Amendments to the SDWA
- B. Water distribution D. None of the above

273. There are specific microbial pathogens, such as _____, which can cause illness, and are highly resistant to traditional disinfection practices.
- A. Cryptosporidium
 - B. E. coli host culture
 - C. Protozoa
 - D. None of the above

What are Disinfection Byproducts (DBPs)?

274. 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
275. Total trihalomethanes and haloacetic acids are widely occurring _____ formed during disinfection with chlorine and chloramine.
- A. Gases
 - B. Substances
 - C. Classes of DBPs
 - D. None of the above

Disinfection Byproduct Research and Regulations Summary

276. _____ is unquestionably the most important step in the treatment of water for drinking water supplies.
- A. DBP(s)
 - B. Turbidity (particle)
 - C. Disinfection
 - D. None of the above
277. The _____ should not be compromised because of concern over the potential long-term effects of disinfectants and DBPs.
- A. DBP(s)
 - B. Turbidity (particle)
 - C. Microbial quality of drinking water
 - D. None of the above

Bacteriological Monitoring Section

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

278. Which of the following like salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming?
- A. Radioactive contaminants
 - B. Pesticides and herbicides
 - C. Inorganic contaminants
 - D. Microbial contaminants
279. Which of the following may come from a variety of sources such as agriculture, urban stormwater run-off, and residential uses?
- A. Radioactive contaminants
 - B. Pesticides and herbicides
 - C. Inorganic contaminants
 - D. Microbial contaminants
280. Which of the following, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife?
- A. Microbial contaminants
 - B. Pesticides and herbicides
 - C. Inorganic contaminants
 - D. All of the above
281. Which of the following can be synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can come from gas stations, urban stormwater run-off, and septic systems?
- A. Organic chemical contaminants
 - B. Pesticides and herbicides
 - C. Inorganic contaminants
 - D. Microbial contaminants

Background

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

A. True B. False

TCR

283. 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

284. 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

285. 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

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

A. True B. False

287. 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

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

A. True B. False

289. 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

290. 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

291. 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

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

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

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

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

294. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, and cramps)?

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

295. Which of the following is a species of the rod-shaped bacterial genus Shigella?

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

296. Which of the following can cause bacillary dysentery?

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

297. Which of the following are Gram-negative, non-spore-forming, facultatively anaerobic, non-motile bacteria.

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

298. Which of the following are microscopic organisms that live in the intestines of warm-blooded animals? They also live in the waste material, or feces, excreted from the intestinal tract. When fecal coliform bacteria are present in high numbers in a water sample, it means that the water has received fecal matter from one source or another.

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

299. Which of the following are common in the environment and are generally not harmful? However, the presence of these bacteria in drinking water are usually a result of a problem with the treatment system or the pipes which distribute water, and indicates that the water may be contaminated with germs that can cause disease.

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

300. 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

301. 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

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

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

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

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

Bacteria Sampling

304. Water samples for _____ must always be collected in a sterile container.

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

Basic Types of Water Samples

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

- A. True
- B. False

The three (3) primary types of samples are:

306. 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

307. 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

308. A PWS has a second Level 1 Assessment within a rolling 12-month period.

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

309. A PWS on state-approved annual monitoring has a Level 1 Assessment trigger in 2 consecutive years.

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

310. A PWS collecting fewer than 40 samples per month has 2 or more TC+ routine/ repeat samples in the same month.

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

311. 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

312. A PWS collecting at least 40 samples per month has greater than 5.0 percent of the routine/repeat samples in the same month that are TC+.

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

313. Noncommunity and nontransient noncommunity public water systems will sample at the same frequency as a like sized community public water system if:

- 1. It has more than 1,000 daily population and has ground water as a source, or
- 2. It serves 25 or more daily population and utilizes surface water as a source or ground water under the direct influence of surface water as its source.

- A. True
- B. False

314. Noncommunity and nontransient, noncommunity water systems with less than 10,000 daily population and groundwater as a source will sample on an annual basis.

- A. True
- B. False

Maximum Contaminant Levels (MCLs)

315. State and federal laws establish standards for drinking water quality. Under normal circumstances when these standards are being met, the water is safe to drink with no threat to human health. These standards are known as maximum contaminant levels (MCL). When a particular contaminant exceeds its MCL a potential health threat may occur.

- A. True
- B. False

316. The MCLs are based on extensive research on toxicological properties of the contaminants, risk assessments and factors, short-term (acute) exposure, and long-term (chronic) exposure. You conduct the monitoring to make sure your water is in compliance with the MCL.

- A. True
- B. False

317. There are two types of MCL violations for coliform bacteria. The first is for total coliform; the second is an acute risk to health violation characterized by the confirmed presence of fecal coliform or E. coli.

- A. True
- B. False

Positive or Coliform Present Results

318. If you are notified of a positive coliform test result you need to contact either the Drinking Water Program or your local county health department within 72 hours, or by the next business day after the MCL compliance violation

- A. True
- B. False

319. With a positive total coliform sample, after you have contacted an agency for assistance, you will be instructed as to the proper repeat sampling procedures and possible corrective measures for solving the problem. It is very important to initiate the _____ as the corrective measures will be based on those results.

- A. Perform routine procedures
- B. Repeat sampling immediately
- C. Corrective measures
- D. None of the above

Heterotrophic Plate Count HPC

320. Heterotrophic Plate Count (HPC) --- formerly known as the Bac-T plate, is a procedure for estimating the number of live heterotrophic bacteria and measuring changes during water treatment and distribution in water or in swimming pools.

- A. True
- B. False

Revised Total Coliform Rule (RTCR) Summary

321. EPA published the Revised Total Coliform Rule (RTCR) in the Federal Register (FR) on February 13, 2013 (78 FR 10269). It is the revision to the 1989 Total Coliform Rule (TCR).
A. True B. False

322. The RTCR upholds the purpose of the 1989 TCR to protect public health by ensuring the duplicity of the drinking water distribution system and monitoring for the absence of microbial contamination.
A. True B. False

323. The RTCR establishes criteria for systems to qualify for and stay on for special increased monitoring, which could reduce water system problems for better system operation.
A. True B. False

324. The water provider shall develop and follow a sample-siting plan that designates the PWS's collection schedule. This includes location of _____.
A. Routine and repeat water samples C. Microbial contamination
B. Reduced monitoring D. Repeat water samples

325. The water provider shall collect _____ on a regular basis (monthly, quarterly, annually). Have samples tested for the presence of total coliforms by a state certified laboratory.
A. Routine water samples C. Microbial contamination
B. Reduced monitoring D. Repeat water samples

326. PN is required for violations incurred. Within required timeframes, the PWS must use the required health effects language and notify the public if they did not comply with certain requirements of the RTCR. The type of _____ depends on the severity of the violation.
A. CCR(s) C. MCL violation
B. PN D. TC+ routine or repeat sample

327. The RTCR requires public water systems that are vulnerable to microbial contamination to identify and fix problems.
A. True B. False

328. The water provider shall collect repeat samples (at least 3) for each TC+ positive routine sample.
A. True B. False

329. For PWSs on quarterly or annual routine sampling, collect additional routine samples (at least 3) in the month after a _____ .
A. CCR(s) C. Total coliform positive samples
B. PN D. TC+ routine or repeat sample

330. PWSs incur violations if they do not comply with the requirements of the RTCR. The violation types are essentially the same as under the TCR with few changes. The biggest change is no acute or monthly MCL violation for _____ only.
A. CCR(s) C. Total coliform positive samples
B. PN D. TC+ routine or repeat sample

331. Community water systems (CWSs) must use specific language in their CCRs when they must conduct an assessment or if they incur _____.

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

332. The water provider shall analyze all _____ that are total coliform positive (TC+) for E. coli.

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

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

- A. True
- B. False

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

- A. True
- B. False

Disinfection Key

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

- A. Enteric viruses
- B. Crypto
- C. Giardia lamblia cysts
- 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

337. The RTCR requires 99.9% or 3 log inactivation of _____.

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

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

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

Waterborne Pathogen Section - Introduction Pathogen Section

339. Most pathogens are generally associated with diseases that _____ and affect people in a relatively short amount of time, generally a few days to two weeks.

- A. Cause intestinal illness
- B. Are mild in nature
- C. Will cause fatalities
- D. None of the above

How Diseases are Transmitted.

340. Waterborne pathogens are primarily spread by the?

- A. Fecal-oral, or feces-to-mouth route
- B. Dermal to fecal route
- C. Oral to fecal route
- D. None of the above

Protozoan Caused Diseases

341. Which of the following bugs is larger than bacteria and viruses but still microscopic; they invade and inhabit the gastrointestinal tract?

- A. Hepatitis A
- B. E.coli
- C. Protozoan pathogens
- D. None of the above

Giardia lamblia

342. Which of the following bugs has been responsible for more community-wide outbreaks of disease in the U.S. than any other, and drug treatment are not 100% effective?

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Giardiasis
- D. None of the above

343. All of these diseases, with the exception of _____, have one symptom in common: diarrhea. They also have the same mode of transmission, fecal-oral, whether through person-to-person or animal-to-person contact.

- A. HIV infection
- B. Giardiasis
- C. Hepatitis A
- D. None of the above

Primary Waterborne Diseases Section

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

- A. True
- B. False

345. Vibrio cholerae, the basics. It's a virus. It causes diarrheal illness, also known as cholera. It is typically associated with aquatic environments, shell stocks, and human. Vibrio cholerae has also been associated with ship ballast water.

- A. True
- B. False

346. Legionella, prevention. Legionella in water systems. Hot water in tanks should be maintained between _____ degrees Centigrade.

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

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

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

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

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

349. Schistosomatidae, the basics. It is a parasite. It is acquired through dermal contact, cercarial dermatitis. It is commonly known as?

- A. Swimmer's itch
- B. Beaver fever
- C. Hemorrhagic colitis
- D. None of the above

Chain of Custody Procedures

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

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

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

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

Factors in Chlorine Disinfection: Concentration and Contact Time

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

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

Disinfection Section

Chlorine's Appearance and Odor

353. 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

354. 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

355. 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

356. 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

357. 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

358. 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

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

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

Reactivity

360. 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

361. 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

362. 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

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

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

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

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

Flammability

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

- A. True
- B. False

366. 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

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

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

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

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

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

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

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

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

371. Chlorination is more effective as?

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

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

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

373. Chlorination is less effective in?

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

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

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

Chlorination Chemistry

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

- A. True
- B. False

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

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

- A. True
- B. False

378. 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

379. 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

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

- A. True
- B. False

381. 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

382. 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

383. 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

384. 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

385. What is OSHA's PEL?

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

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

- A. True
- B. False

387. Liquid chlorine is about _____ times heavier than water

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

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

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

Alternate Disinfectants - Chloramine

389. 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

390. 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

Ozone

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

- A. True
- B. False

392. 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

393. 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

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

395. Ozonation must include adequate ozone leak detection alarm systems, and an ozone off-gas destruction system.
A. True B. False

Chlorine Dioxide

396. Which term provides good Giardia and virus protection but its use is limited by the restriction on the maximum residual of 0.5 mg/L ClO_2 /chlorite/chlorate allowed in finished water?
A. Chlorinated byproducts C. Ammonia residual(s)
B. Chlorine dioxide D. None of the above

397. If chlorine dioxide is being used as an oxidant, the preferred method of generation is to entrain or _____ into a packed reaction chamber with a 25% aqueous solution of sodium chlorite (NaClO_2).
A. Chloramine C. Chlorine dioxide
B. Chlorine gas D. None of the above

398. Which chemical is explosive and can cause fires in feed equipment if leaking solutions or spills are allowed to dry out?
A. Dry sodium chlorite C. Ammonia
B. Chlorine dioxide D. None of the above

399. Chlorine dioxide may be used for either taste or odor control or as a?
A. Chloramine D. Gas
B. Pre-disinfectant D. None of the above

400. 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