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

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

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You will have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to info@tlch2o.com.

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

Aquifer

1. Many terms are used to describe the nature and extent of the groundwater resource, the level below which all the spaces are filled with water is called the?

A. Unconfined aquifer(s) D. Well(s)
B. Groundwater E. Aquifer
C. Water table F. None of the Above

2. Above the water table lies the_____.

A. Unsaturated zone D. Soil moisture
B. Drinking water E. Karst
C. Water table F. None of the Above

3. The entire region below the water table is called the “saturated zone” and water in this saturated zone is called?

A. Unconfined aquifer(s) D. Well(s)
B. Groundwater E. Aquifer
C. Water table F. None of the Above

4. _____ are cracks, joints, or fractures in solid rock, through which groundwater moves.

A. Fractured aquifer(s) D. Soil moisture
B. Drinking water E. Karst
C. Water table F. None of the Above

5. Limestone is often located in _____.

A. Unconfined aquifer(s) D. Fractured aquifer(s)
B. Groundwater E. Aquifer
C. Water table F. None of the Above

6. Which of the following terms such as sandstone may become so highly cemented or re-crystalized that all of the original space is filled?

A. Unconfined aquifer(s) D. Fractured aquifer(s)
B. Groundwater E. Aquifer
C. Porous media F. None of the Above

7. Clay has many spaces between its grains, but the spaces are not large enough to permit free movement of water.
A. True B. False

8. Which of the following terms usually flows downhill with the slope of the water table?
A. Well D. Soil moisture
B. Drinking water E. Groundwater
C. Water table F. None of the Above

9. _____ flow in the aquifers underlying springs or surface drainage basins, and does not always mirror the flow of water on the surface.
A. Well D. Soil moisture
B. Drinking water E. Groundwater
C. Water table F. None of the Above

10. Which of the following terms may move in different directions below the ground than the water flowing on the surface?
A. Well D. Soil moisture
B. Drinking water E. Groundwater
C. Water table F. None of the Above

11. Unconfined aquifers are those that are bounded by the water table. Some aquifers lie beneath layers of impermeable materials.
A. True B. False

12. A well in such an aquifer is called an “artesian well”.
A. True B. False

13. Which of the following terms is the level to which the water in an artesian aquifer will rise?
A. Unconfined aquifer(s) D. Well(s)
B. Piezometric surface E. Aquifer
C. Water table F. None of the Above

Cone of Depression
14. When pumping begins, water begins to flow towards the well in contrast to the natural direction of groundwater movement.
A. True B. False

15. The water level in the well falls below the water table in the_____.
A. Water table D. Cone of depression
B. Groundwater E. Well
C. Surrounding aquifer F. None of the Above

16. The movement of water from this term into a well results in the formation of a cone of depression.
A. Confined aquifer D. Water table
B. An aquifer E. Unconfined aquifer
C. Hydrologic cycle F. None of the Above

17. Which of the following terms describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?
A. Water table D. Cone of depression
B. Groundwater E. Well
C. Gravity F. None of the Above

18. _____ 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. Water table D. Cone of depression
B. Groundwater E. Well
C. Drawdown F. None of the Above

19. When a well is installed in this missing term, 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 D. Water table
B. Aquifer(s) E. An unconfined aquifer
C. Hydrologic cycle F. None of the Above

Where Is Ground Water Stored?
20. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, a term that literally means_____.
A. Water table D. Cone of depression
B. Groundwater E. Well
C. Water bearer F. None of the Above

21. Which of the following terms store water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?
A. Confined aquifer D. Water table
B. Aquifer(s) E. Unconfined aquifer
C. Hydrologic cycle F. None of the Above

22. Which of the following terms is controlled largely by its porosity, or the relative amount of open space present to hold water?
A. Water table D. Cone of depression
B. Groundwater E. Well
C. An aquifer's storage capacity F. None of the Above

23. There are two kinds of aquifers: confined and unconfined.
A. True B. False

24. If the aquifer is sandwiched between layers of relatively impermeable materials, it is called?
A. Confined aquifer D. Water table
B. Aquifer(s) E. Unconfined aquifer
C. Hydrologic cycle F. None of the Above

25. Confined aquifers are not sandwiched between layers of relatively impermeable materials, and their upper boundaries are generally closer to the surface of the land.
A. True B. False

26. _____ is frequently found at greater depths than unconfined aquifers?
A. Confined aquifer(s) D. Water table
B. Aquifer(s) E. Unconfined aquifer
C. Hydrologic cycle F. None of the Above

Does Ground Water Move?
27. Ground water can move sideways as well as up or down. This movement is in response to gravity, differences in elevation, and?
A. Synthetic organic chemical(s) D. Ground-water contamination
B. Differences in pressure E. Septic tanks, cesspools, and privies
C. Permeable zones F. None of the Above

28. Ground water can move even more rapidly in karst aquifers, which are areas in which missing term 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. Contaminant(s) D. Water soluble limestone
B. Saturated zone E. Serious contamination source(s)
C. Karst aquifer(s) F. None of the Above

Ground-Water Quality
29. 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

30. Some contaminants can pass through all of these filtering layers into _____ to contaminate ground water.
A. Contaminant(s) D. Saturated zone
B. Saturated zone E. Water table
C. Karst aquifer(s) F. None of the Above

How Does Ground Water Become Contaminated?
31. Groundwater contamination can originate on the surface of the ground, in the ground above the water table, or in the ground below the_____.
A. Synthetic organic chemical(s) D. Ground-water contamination
B. Ground water E. Water table
C. Permeable zones F. None of the Above

32. If the contaminant is introduced directly into the area below the _____, the primary process that can affect the impact of the contaminant is dilution by the surrounding ground water.
A. Contaminant(s) D. Saturated zone
B. Saturated zone E. Water table
C. Karst aquifer(s) F. None of the Above

What Kinds of Substances Can Contaminate Groundwater, and Where Do They Come from?
33. Substances that can contaminate this missing term 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) D. Ground-water contamination
B. Ground water E. Septic tanks, cesspools, and privies
C. Permeable zones F. None of the Above

34. A significant number of today's ground-water 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. Iron, calcium, and selenium
E. Serious contamination source(s)
F. None of the Above

Agricultural Activities

35. Agricultural activities also can make significant contributions to this missing term contamination with the millions of tons of fertilizers and pesticides spread on the ground and from the storage and disposal of livestock wastes.

A. Synthetic organic chemical(s)
B. Ground water
C. Permeable zones
D. Groundwater
E. Septic tanks, cesspools, and privies
F. None of the Above

Landfills

36. A number of these sites have caused _____ and are now being cleaned up by their owners, operators, or users; state governments; or the federal government under the Superfund program.

A. Synthetic organic chemical(s)
B. Ground water
C. Permeable zones
D. Serious ground-water contamination problems
E. Septic tanks, cesspools, and privies
F. None of the Above

Abandoned Wells

37. Which of the following terms can be another source of ground-water contamination?

A. Contaminant(s)
B. Saturated zone
C. Karst aquifer(s)
D. Wells
E. Serious contamination source(s)
F. None of the Above

38. If which of the following terms is abandoned without being properly sealed, however, it can act as a direct channel for contaminants to reach groundwater?

A. Synthetic organic chemical(s)
B. Ground water
C. A well
D. Ground-water contamination
E. Septic tanks, cesspools, and privies
F. None of the Above

What Can Be Done After Contamination Has Occurred?

39. In general, a community whose ground-water supply has been contaminated has five options: Contain the contaminants to prevent their migration from_____.

A. Aquifer
B. Contamination
C. Toxic chemicals
D. Supplies of clean ground water
E. Their source
F. None of the Above

40. According to the text, withdraw the pollutants from the_____.

A. Aquifers
B. Contamination
C. Toxic chemicals
D. Supplies of ground water
E. Wellhead protection program(s)
F. None of the Above

41. According to the text, treat the _____ where it is withdrawn or at its point of use.

A. Aquifer
B. Contamination
C. Toxic chemicals
D. Ground water
E. Wellhead protection program(s)
F. None of the Above

42. Rehabilitate the missing term by either immobilizing or detoxifying the contaminants while they are still in the aquifer.
A. Aquifer D. Supplies of clean ground water
B. Contamination E. Wellhead protection program(s)
C. Toxic chemicals F. None of the Above

43. According to the text, abandon the use of the aquifer and find?
A. Aquifer D. Ground water
B. Contamination E. Wellhead protection program(s)
C. Alternative sources of water F. None of the Above

Water Use or Demand
44. Water system demand comes from a number of sources including residential, commercial, industrial and public consumers as well as waste and some_____.
A. Pressure D. Unavoidable loss and waste
B. System integrity E. Maximum daily use
C. Unavoidable loss F. None of the Above

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

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

47. _____ is desired, that could also represent a rather significant demand upon the system?
A. Distribution system D. Hydropneumatic tanks and surge tanks
B. Water pressure E. Cavitation
C. Fire protection F. None of the Above

48. A common design assumption is to use between 100 to 150 gallons per person per day for average domestic use.
A. True B. False

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

50. Which of the following terms is usually encountered during the summer months and can vary widely depending on irrigation practices?
A. Pressure D. Unavoidable loss and waste
B. System integrity E. Maximum daily use
C. Maximum daily use F. None of the Above

Water Pressure
51. 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

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

53. 20 psi is considered the minimum required at any point in the water system, so that _____ is prevented.

A. Distribution system
B. Water pressure
C. Backflow and infiltration
D. Hydropneumatic tanks and surge tanks
E. Cavitation
F. None of the Above

54. Which of the following terms is provided by the direct force of the water, or by the height of the water?

A. Pressure
B. System integrity
C. Gravity
D. Unavoidable loss and waste
E. Maximum daily use
F. None of the Above

Water Well Reports and Hydrogeology

Hydrogeologic Data

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

A. True B. False

Depth to the Aquifer

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

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

Nature of the Aquifer

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

A. Hydraulic head
B. Water table
C. A confined aquifer
D. Hydraulic conductivity
E. Permeability, or hydraulic conductivity
F. None of the Above

58. 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. Aquifer (porosity)
B. Hydraulic head
C. Geologic materials
D. Water table
E. Ground water
F. None of the Above

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

A. Hydraulic head
B. An aquifer
C. A confined aquifer
D. Hydraulic conductivity
E. Permeability, or hydraulic conductivity
F. None of the Above

Hydraulic Head (h)

60. According to the text, 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

61. _____ has units of feet, and generally corresponds to the elevation of water in the well?
A. Aquifer (porosity)
B. Hydraulic head
C. Geologic materials
D. Amount of recharge to the aquifer
E. Ground water
F. None of the Above

62. Hydraulic head is the driving force for ground water movement either in a horizontal or vertical direction.
A. True B. False

63. Which of the following terms moves from where the head is higher to where the head is lower?
A. Hydraulic head
B. An aquifer
C. Ground water
D. Hydraulic conductivity
E. Permeability or hydraulic conductivity
F. None of the Above

Aquifer Porosity (n)
64. The volume of open space relative to the _____and the degree to which these pore spaces are interconnected controls the volume of water in the aquifer and the amount of water that can be reasonably withdrawn from the aquifer.
A. Total volume of the aquifer (porosity)
B. Hydraulic head
C. Geologic materials
D. Amount of recharge to the aquifer
E. Ground water
F. None of the Above

Permeability of the Aquifer (K)
65. _____ or the permeability of the aquifer is a measure of how fast ground water can move through the aquifer?
A. Hydraulic head
B. An aquifer
C. A confined aquifer
D. Conductivity
E. Hydraulic conductivity
F. None of the Above

66. 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. An aquifer
C. A confined aquifer
D. Hydraulic conductivity
E. Permeability
F. None of the Above

In What Direction Is Groundwater Flowing?
67. If several wells produce from the same aquifer, we can estimate the direction of ground water flow.
A. True B. False

68. The direction of ground water flow is from higher to lower_____._
A. Aquifer (porosity)
B. Hydraulic head
C. Geologic materials
D. Amount of recharge to the aquifer
E. Ground water
F. None of the Above

69. Which of the following terms 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. An aquifer
C. A confined aquifer
D. Hydraulic conductivity
E. Permeability or hydraulic conductivity
F. None of the Above

What Is the Drawdown Associated with Pumping of a Well?

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

A. Aquifer (porosity)
B. Hydraulic head
C. Geologic materials
D. Amount of recharge to the aquifer
E. Storage coefficient of the aquifer
F. None of the Above

Depth to First Water-Bearing Zone

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

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

Static Water Level

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

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

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

A. True B. False

74. A progressive change in the perforated portions of cased wells can indicate to the hydrogeologist that the area represents a recharge zone or a discharge zone.

A. True B. False

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

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

76. _____ have important implications in ground water protection and identifying the relation between area ground water and local streams?

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

Water-Bearing Zones

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

A. True B. False

78. Arriving at accurate estimates of aquifer parameters or calculating ground water velocity requires us to know the thickness of the?
A. Water-bearing zone(s) D. Recharge and discharge zone(s)
B. SWL E. Hydrogeologic investigation(s)
C. Yield F. None of the Above

Lithologic Log
79. The well log portion of the well report describes what the driller encountered in the subsurface.
A. True B. False

80. Clear descriptions of the material drilled through the relative proportions of silt/clay in the sand units, the locations of weak zones in bedrock, whether a clay unit contains lenses or layers of sand, etc., allow the hydrogeologist to better estimate the potential permeability of _____.
A. Static water level D. Perforated portions of cased wells
B. These zones E. Weak (fractured) zones
C. Local ground water systems F. None of the Above

Contributions of Well Constructors to Hydrogeology
81. This document stresses the importance of data that is recorded on well reports and how that data influences hydrogeologic investigations.
A. True B. False

82. Well constructors can provide important contributions to the science by making careful observations and measurements when recording that data on the?
A. Static water level D. Perforated portions of cased wells
B. Well report E. Weak (fractured) zones
C. Local ground water systems F. None of the Above

How Wells Are Drilled
83. A few examples of today's more common well drilling methods include rotary, auger, and cable tool with?
A. Many variations of each D. A highly trained and skilled driller
B. Typical drilling fluid(s) E. Today's more common well drilling methods
C. Advanced methods F. None of the Above

84. Drilling fluids are often utilized during drilling in order to keep the borehole open while drilling is done.
A. True B. False

85. Which of the following terms stabilize the hole and aid in the removal of cuttings?
A. The flighting D. A telescoping kelly
B. Drilling fluids E. The cutting head
C. The bucket F. None of the Above

86. Typical drilling fluids may be water, mud, air, chemical or natural additives, or combinations of each.
A. True B. False

87. Air rotary with _____ is particularly suited for hard rock drilling, while mud rotary is better suited for drilling in sediment.
A. Downhole hammer D. A sub
B. The Kelly E. Rotary bit
C. The table drive F. None of the Above

Basic Rotary Drilling Methods
88. Rotary drilling utilizes two methods that include: direct and reverse mud rotary, direct air rotary, and?
A. Rotary drilling D. Drill through casing driver methods
B. Typical drilling fluid(s) E. Blasting
C. Advanced methods F. None of the Above

The Rotary Drill String
89. Rotary drilling methods use a drill string, which typically consists of a bit, collar, drill pipe and?
A. The drill collar D. Shock absorber (floating sub)
B. Drag bit(s) E. A kelly
C. Roller bit(s) F. None of the Above

90. Which of the following terms is a section of heavy walled pipe that can be hexagonal, square, or rounded with grooves?
A. The flighting D. A kelly
B. The plug E. The cutting head
C. The bucket F. None of the Above

91. _____ is several feet longer than the drill pipe being used and fits into the table drive much like the splines on a drive shaft fit into a transmission?
A. Drilling method D. A sub
B. The Kelly E. Rotary bit
C. The table drive F. None of the Above

92. Drill pipe can be used in various lengths but are typically 20-foot sections and may be connected to the drive unit with?
A. Drilling method D. A sub
B. The Kelly E. Rotary bit
C. The table drive F. None of the Above

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

94. Which of the following terms or stabilizer is typically very heavy and is often gauged close to the diameter of the bit being used?
A. Drilling method D. The drill collar
B. The Kelly E. Rotary bit
C. The table drive F. None of the Above

95. _____ aids in maintaining a consistent borehole diameter and primarily helps to prevent borehole deviation?
A. The drill collar D. Shock absorber (floating sub)
B. Drag bit(s) E. The kelly
C. Roller bit(s) F. None of the Above

96. Several types of bits may be used; such as drag bits or?
A. The flighting D. A telescoping kelly
B. The plug E. The cutting head
C. Roller bits F. None of the Above

97. Which of the following terms are typically used in unconsolidated to semi-consolidated sand, silt, and clay-rich formations?
A. The drill collar D. Shock absorber (floating sub)
B. Drag bit(s) E. The kelly
C. Roller bit(s) F. None of the Above

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

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

100. Roller bits can be used in consolidated formations and even hard rock applications if equipped with carbide buttons. These types of bits are often referred to as?
A. The drill collar D. Shock absorber (floating sub)
B. Drag bit(s) E. Roller button bits
C. Roller bit(s) F. None of the Above

Direct Rotary Method

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

102. Down-force exerted by the drilling rig and/or the weight of this missing term is used along with rotating action to force the bit downwards, cutting through the sediment or rock.
A. Direct Mud rotary drilling rig(s) D. Drill string
B. Bit E. Loss of mud drilling fluids
C. Large drill rig(s) F. None of the Above

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

What is a Significant Deficiency?

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

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

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

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

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

A. True B. False

Selecting an Appropriate Well Site

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

A. True B. False

108. The ideal well location has good drainage and is higher than_____.

A. The quality of drinking water
B. The possibility of contamination
C. Surface drainage(s)
D. The surrounding ground surface
E. Preliminary aquifer parameters
F. None of the Above

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

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

Common Well Construction Specifications

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

A. Water wells
B. The aquifer
C. A pumping test
D. The amount of water production
E. The optimum pumping rate
F. None of the Above

111. Surface water may enter the well through an opening in the top or by seeping through _____.

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

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

A. True B. False

113. Construction of this missing term must ensure that the top and uppermost 20 feet of the well bore are sealed and watertight.
A. The well
B. The inflatable packer
C. The louver(s)
D. The casing and screen specifications
E. Well screen(s)
F. None of the Above

114. All wells must be constructed with a surface seal to prevent the infiltration of surface water and/or surface contaminants into?
A. The anticipated flow rate
B. The well
C. Annulus and surface casing
D. The well bore and aquifer
E. The upper borehole from the surface
F. None of the Above

115. The seal is constructed by pouring or pumping neat cement grout and/or bentonite between the annulus and surface casing.
A. True B. False

116. _____ is installed in the upper portions of the well bore between the annulus and surface casing and will normally extend to the ground surface around the well.
A. This seal
B. The inflatable packer
C. The louver(s)
D. The casing and screen specifications
E. Well screen(s)
F. None of the Above

117. The installation of the cement or grout between the annulus and surface casing effectively seals off the upper borehole from_____.
A. The anticipated flow rate
B. The well
C. Annulus and surface casing
D. The surface
E. The upper borehole from the surface
F. None of the Above

118. Which of the following terms uses is a solid piece of permanently installed casing, usually steel, that should be of sufficient size to allow the completion of the well within it?
A. The surface casing
B. The inflatable packer
C. The louver(s)
D. The casing and screen specifications
E. Well screen(s)
F. None of the Above

119. Which of the following terms in addition to the surface seal is installed with the pumping equipment to ensure no surface water or debris enters the well?
A. A well seal or cap
B. The well
C. Annulus and surface casing
D. Unstable or non-productive areas
E. The upper borehole from the surface
F. None of the Above

120. Specialized borehole geophysical logging equipment may be used to isolate the areas of optimum production capability and aid in determining the ultimate well design.
A. True B. False

121. Preliminary pumping tests are normally conducted to ensure the well is as productive as originally estimated and to obtain_____.
A. The quality of drinking water
B. The possibility of contamination
C. Surface drainage(s)
D. Contamination of a water
E. Preliminary aquifer parameters
F. None of the Above

Choice of Casing

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

A. True B. False

123. Which of the following terms needed is related to the type of aquifer, well depth, water quality, well use, and regulatory requirements?

A. The type of well casing
B. The inflatable packer
C. The louver(s)
D. The casing and screen specifications
E. Well screen(s)
F. None of the Above

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

A. The anticipated flow rate
B. The well
C. Gravel pack
D. Unstable or non-productive areas
E. The upper borehole from the surface
F. None of the Above

125. A few of the more common types of well screen are: wire wrapped, continuous screen, slotted, louvered, and _____.

A. The centralizer(s)
B. The inflatable packer
C. The louver(s)
D. Perforated screens
E. Well screen(s)
F. None of the Above

126. According to the text, louvered screen is used in low yield production wells but particularly in rock packed wells and may help where cascading water is a problem.

A. True B. False

127. _____ are stronger and less expensive than wire wrapped screens and are best suited to deep applications, where borehole stability is a concern.

A. The anticipated flow rate
B. Slotted and perforated screens
C. Annulus and surface casing
D. Unstable or non-productive areas
E. The upper borehole from the surface
F. None of the Above

Selecting an Optimum Pumping Rate

128. 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. Unstable or non-productive areas
E. The upper borehole from the surface
F. None of the Above

Pump Selection Section

Three Basic Types of Wells

129. Which of the following terms are usually bored into an unconfined water source, generally found at depths of 100 feet or less?

A. Unconsolidated or sand well(s)
B. Bored or shallow well(s)
C. The proper selection
D. Total dynamic or discharge head
E. The most important components
F. None of the Above

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

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

Selection of Pumping Equipment
132. The proper selection of pumping equipment for a well is of great importance.
A. True B. False

133. The primary factors that must be considered before selecting the well pump are: flow rate, line pressure, pumping lift, _____, and size of piping.
A. Power requirements (and limitations)
B. Screen filter(s)
C. Power requirement(s)
D. Total equivalent feet of lift
E. The total friction head
F. None of the Above

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

135. Which of the following terms refers to the total equivalent feet of lift that the pump must overcome in order to deliver water to its destination, including frictional losses in the delivery system?
A. Total dynamic head
B. Screen filter(s)
C. Power requirement(s)
D. Total equivalent feet of lift
E. The total friction head
F. None of the Above

Basic Pump Operating Characteristics
136. Pressure and head are interchangeable concepts in irrigation, because a column of water .433 feet high is equivalent to 2.31 pound per square inch of pressure.
A. True B. False

137. _____ refers to the height of a vertical column of water.
A. Head
B. Suction head
C. Velocity head
D. Loss of head
E. Pressure head
F. None of the Above

138. Which of the following terms of a pump is composed of several types of head that help define the pump's operating characteristics?
A. Cavitation
B. Suction head
C. Velocity head
D. Total head
E. Pressure head
F. None of the Above

Total Dynamic Head

139. The total dynamic head of a pump is the sum of _____, the pressure head, the friction head, and the velocity head.

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

140. The Total Dynamic Head is the sum of the total static head, _____ and the pressure head.

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

Total Static Head

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

A. True
B. False

142. When pumping from a well, it would be the distance from the pumping water level in the well to the ground surface plus _____ the water is lifted from the ground surface to the discharge point.

A. Friction head
B. Total static head
C. Vertical distance
D. Total dynamic or discharge head
E. Loss of head
F. None of the Above

Pressure Head

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

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

144. 20 PSI is equal to 20 times 2.31 or 46.2 feet of head.

A. True
B. False

Friction Head

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

A. True
B. False

146. The velocity of the water has a significant effect on?

A. Friction head
B. Friction loss
C. Pressure head
D. Total dynamic or discharge head
E. Loss of head
F. None of the Above

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

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

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

Velocity Head
149. Velocity head is the energy of the water due to_____.
A. Cavitation
B. Suction head
C. Velocity head
D. Loss of head
E. Its velocity
F. None of the Above

Suction Head
150. According to the text, the suction head includes not only the vertical suction lift, but also the friction losses through the pipe, elbows, foot valves, and other fittings on the suction side of the pump.
A. True B. False

151. According to the text, a pump operating above a water surface is working with?
A. Friction head
B. A suction head
C. Pressure head
D. Total dynamic or discharge head
E. Loss of head
F. None of the Above

152. There is an allowable limit to _____ on a pump and the net positive suction head of a pump sets that limit.
A. Cavitation
B. Suction head
C. Velocity head
D. Loss of head
E. Pressure head
F. None of the Above

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

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

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

156. Operating a pump with this missing term than it was originally designed for, or under conditions with excessive vacuum at some point in the impeller, may cause cavitation.
A. Suction lift greater
B. Suction head
C. Velocity head
D. Loss of head
E. Pressure head
F. None of the Above

157. Which of the following terms is the implosion of bubbles of air and water vapor and makes a very distinct noise like gravel in the pump?
A. Friction head
B. Total static head
C. Pressure head
D. Cavitation
E. Loss of head
F. None of the Above

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

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

Water Storage Introduction
160. According to the text, treated or pumped water is placed in _____in order for disinfection to take place.
A. Storage reservoirs
B. Water distribution systems
C. Steel reservoirs
D. A closed tank or reservoir
E. Repairing and replacing these facilities
F. None of the Above

161. Which of the following terms 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
C. System integrity
D. Barrier
E. Clearwells
F. None of the Above

Backflow/Cross-Connection Section
What is backflow? Reverse flow condition
162. Which of the following terms is any temporary or permanent connection between a public water system or consumer's potable water system and any source or system containing nonpotable water or other substances?
A. Backflow
B. Backpressure
C. Backsiphonage
D. Cross-connection
E. Indirect connection
F. None of the Above

163. Which of the following terms is a form of backflow caused by a negative pressure (i.e., a vacuum or partial vacuum) in a public water system or consumer's potable water system?
A. Backflow
B. Backpressure
C. Backsiphonage
D. Cross-connection
E. Indirect connection
F. None of the Above

164. 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. Backpressure
C. Backsiphonage
D. Cross-connection
E. Indirect connection
F. None of the Above

165. The principal types of mechanical backflow preventers are the reduced-pressure principle assembly, the _____, and the double check valve assembly.
A. High hazard installations
B. Air gap
C. Vacuum breaker
D. Backflow
E. Device or method
F. None of the Above

166. Which of the following terms can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?
A. Backflow D. Cross-connection
B. Backpressure E. Indirect connection
C. Backsiphonage F. None of the Above

167. _____ is a form of backflow caused by a downstream pressure that is greater than the upstream or supply pressure in a public water system or consumer's potable water system.
A. Backflow D. Cross-connection
B. Backpressure E. Indirect connection
C. Backsiphonage F. None of the Above

168. Which of the following terms can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both?
A. Backflow D. Cross-connection
B. Backpressure E. Indirect connection
C. Backsiphonage F. None of the Above

169. _____ in which there are two forms-backpressure and backsiphonage.
A. Backflow D. Cross-connection
B. Backpressure E. Indirect connection
C. Backsiphonage F. None of the Above

170. The basic mechanism for preventing backflow is a mechanical _____, which provides a physical barrier to backflow.
A. High hazard installations D. Backflow
B. Air gap E. Device or method
C. Backflow preventer F. None of the Above

171. _____ is the means or mechanism to prevent backflow?
A. High hazard installations D. Backflow
B. Air gap E. Device or method
C. Backflow preventer F. None of the Above

172. According to the text, basic means of preventing backflow is an _____, which either eliminates a cross-connection or provides a barrier to backflow.
A. High hazard installations D. Backflow
B. Air gap E. Device or method
C. Backflow preventer F. None of the Above

Types of Backflow Prevention Methods and Assemblies
173. _____ must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?
A. Backflow D. Cross-connection
B. Backpressure E. Indirect connection
C. Backsiphonage F. None of the Above

174. The type of device selected for a particular installation depends on several factors.
A. True B. False

175. When the airflow is restricted, such as the case of an air gap located near a wall, the _____ separation must be increased.
A. Open receiving vessel D. Air gap
B. Backflow preventer E. Air break
C. Barrier to backflow F. None of the Above

176. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of an?
A. Open receiving vessel D. Air gap
B. Backflow preventer E. Air break
C. Barrier to backflow F. None of the Above

177. Which of the following terms must be at least two times the diameter of the supply pipe and not less than one inch?
A. Open receiving vessel D. Air gap
B. Backflow preventer E. Air break
C. Barrier to backflow F. None of the Above

Water Distribution Section
Water Distribution System Design and Valves
System Elements
178. Valves control the flow of water in the distribution system by isolating areas for repair or by?
A. Increase water pressure D. Main line isolation
B. Bypasses E. Regulating system flow or pressure.
C. Complete gridiron system F. None of the Above

179. According to the text, gate valves should be used in the _____for main line isolation.
A. Increase water pressure D. Distribution system
B. Distribution tree E. Arterial system
C. Complete gridiron system F. None of the Above

180. Distribution mains function is to carry water from the water source or treatment works to users, these are the pipelines that make up the?
A. Increase water pressure D. Distribution system
B. Distribution tree E. Arterial system
C. Complete gridiron system F. None of the Above

181. Arterial mains are interconnected with smaller distribution mains to form a complete gridiron system and are for?
A. Increasing water pressure D. Distribution mains of large size
B. Tree system E. Fire protection
C. Complete gridiron system F. None of the Above

182. Storage reservoirs are structures used to store water and _____ the supply or pressure in the distribution system.
A. Increase water pressure D. Main line isolation
B. Equalize E. Provide a reserve pressure
C. Complete gridiron system F. None of the Above

Butterfly Valve

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

A. Regulator
B. Bypass
C. Complete gridiron system
D. Main line isolation
E. PRV
F. None of the Above

Water Distribution Valves

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

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

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

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

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

A. True B. False

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

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

Gate Valves

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

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

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

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

Valve Exercising

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

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

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

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

192. Service connections are used to _____ or other plumbing systems to the distribution system mains.

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

System Layouts

Tree System

193. Newer water systems are frequently expanded with planning and developed into a tree-like system.

A. True B. False

Friction Loss

194. During periods of peak fire flow demand, there will be less impact from _____ in water mains as the velocity within any given section of main.

A. Carrying capacity
B. Friction loss
C. Pressure
D. Static pressure
E. Total pressure
F. None of the Above

Types of Pipes Used in the Water Distribution Field

Plastic Pipe (PVC)

195. Plastic pipe has seen extensive use available in different lengths and sizes; it is lighter than steel or copper and requires no special tools to install.

A. True B. False

Cast Iron (CIP)

196. CIP can be found in diameters from 3" to 48".

A. True B. False

Ductile Iron Pipe (DIP)

197. DIP's main advantage is that it is _____by internal or external pressures.

A. Overcome the breakage problems
B. Withstand shock loads
C. Extend the life
D. Provide a High C Factor
E. Nearly indestructible
F. None of the Above

Water Sampling Terms and Definitions

Microbes

198. Coliform bacteria are common in the environment and are considered harmful.

A. True B. False

199. The presence of these bacteria in drinking water indicates that the water may be contaminated with germs that can cause disease.

A. True B. False

200. Microbes in human wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms and are caused by?
A. Fecal Coliform and E coli
B. Giardia lamblia
C. Microorganisms
D. Cryptosporidiosis
E. Coliform bacteria
F. None of the Above

How Diseases are Transmitted.
201. For another person to become infected, he or she must take that pathogen in through the mouth.
A. True B. False

202. This term means that it in nature is different from other types of pathogens such as the viruses that cause influenza (the flu) or the bacteria that cause tuberculosis.
A. Fecal Coliform and E coli
B. Giardia lamblia
C. Microorganism(s)
D. Waterborne Pathogen(s)
E. Coliform bacteria
F. None of the Above

203. According to the text, _____are spread by secretions that are coughed or sneezed into the air by an infected person.
A. Fecal Coliform and E coli
B. Giardia lamblia
C. Microorganisms
D. Influenza virus and tuberculosis bacteria
E. Coliform bacteria
F. None of the Above

Viral-Caused Diseases
204. Which of the following terms is an example of a common viral disease that may be transmitted through water? The onset is usually abrupt with fever, malaise, loss of appetite, nausea and abdominal discomfort, followed within a few days by jaundice.
A. Pathogen
B. Yersiniosis
C. Hepatitis A
D. Campylobacteriosis
E. Incubation period
F. None of the Above

Protozoan Caused Diseases
205. _____ is larger than bacteria and viruses but still microscopic, they invade and inhabit the gastrointestinal tract.
A. HIV infections
B. Symptoms
C. Giardiasis
D. Hepatitis A
E. Protozoan pathogens
F. None of the Above

206. A few of the parasites enter the environment in a dormant form, with a protective cell wall, called a?
A. Lamblia
B. Shell
C. Case
D. Cyst
E. Infection
F. None of the Above

Giardia lamblia
207. _____ has been responsible for more community-wide outbreaks of disease in the U.S. than any other, drug treatment is not 100% effective.
A. HIV infection
B. Giardia lamblia
C. Giardiasis
D. Hepatitis A
E. Cryptosporidiosis
F. None of the Above

Cryptosporidiosis

208. The mode of transmission of _____ is fecal-oral, either by person-to-person or animal-to-person, there is no specific treatment.

A. HIV infection
B. Giardia lamblia
C. Giardiasis
D. Hepatitis A
E. Cryptosporidiosis
F. None of the Above

Bacteriological Monitoring Section

209. 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
B. Bacteria tests
C. Contaminate
D. Microbiological analysis
E. Presence of an indicator
F. None of the Above

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

A. Sample container
B. Bacteria tests
C. Coliform bacteria
D. Escherichia coli (E. coli)
E. Iron bacteria
F. None of the Above

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

A. Indicator bacteria
B. Bacteria tests
C. Contamination
D. Coliform bacteria
E. Presence of an indicator
F. None of the Above

Bacteria Sampling

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

A. Indicators
B. Bacteria tests
C. Contamination
D. pH analysis
E. Presence of an indicator
F. None of the Above

Types of Water Samples

213. It is important to properly identify the type of _____ you are collecting.

A. Colilert
B. Coliforms
C. Sample
D. Total coliform analysis
E. Pathogens
F. None of the Above

The three (3) types of samples are:

214. 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
B. Special
C. QA QC
D. Total coliform analysis
E. Routine
F. None of the Above

Sampling Procedures

215. This procedure must be followed and all operating staff must be clear on how to follow the sampling plan.

A. Seal individual samples
B. Chain of custody
C. Distribution system
D. Sample siting plan
E. Positive for total coliform
F. None of the Above

Positive or Coliform Present Results

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

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

Chain of Custody Procedures

217. Each custody sample requires a _____ record and may require a seal. If you do not seal individual samples, then seal the containers in which the samples are shipped.

A. Seal individual samples
B. Chain of custody
C. Distribution system
D. Sample siting plan
E. Positive for total coliform
F. None of the Above

Chlorine Gas Section

218. When chlorine is added into the water stream, chlorine hydrolyzes into_____.

A. HCL
B. Sodium hypochlorite
C. Bromoform
D. Chlorine Acid
E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
F. None of the Above

219. When chlorine hydrolyzation occurs, it provides an active toxicant, _____, which is pH-dependent. In alkaline cooling systems, it readily dissociates to form the hypochlorite ion (OCl-).

A. HCl
B. HOCl
C. High chlorine concentrations
D. pH of 7.0 than at pH 8.5
E. the hypochlorite ion (OCl-)
F. None of the Above

Pathophysiology

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

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

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

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

Mechanism of Activity

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

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

223. 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

Solubility Effects

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

A. Hydrochloric acid
B. H2SO4
C. Hypocaloric acid
D. Sodium hypochlorite solution
E. Sulfuric Acid
F. None of the Above

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

A. Hydrochloric acid
B. H2SO4
C. Hypochloric acid
D. Sodium hypochlorite solution
E. Sulfuric Acid
F. None of the Above

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

A. Hydrochloric acid
B. H2SO4
C. Hypochloric acid
D. Hypochlorous acid
E. Sulfuric Acid
F. None of the Above

Early Response to Chlorine Gas

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

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

Pathological Findings

228. According to the text, treatment plants use _____to reduce water levels of microorganisms that can spread disease to humans.

A. HCl
B. HOCl
C. High chlorine concentrations
D. Chlorine
E. The hypochlorite ion (OCl-)
F. None of the Above

Exposure

229. There is no threshold value for to sodium hypochlorite exposure. Various health effects occur after exposure to sodium hypochlorite. People are exposed to sodium hypochlorite by inhalation of aerosols. This causes coughing and a sore throat. After swallowing sodium hypochlorite, the effects are stomachache, a burning sensation, coughing, diarrhea, a sore throat and vomiting. Sodium hypochlorite on skin or eyes causes redness and pain.

A. True B. False

Chemistry of Chlorination

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

A. True B. False

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

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

Types of Residual
233. _____ is all chlorine that is available for disinfection.
A. Chlorine residual D. Break-point chlorination
B. Chlorine demand E. Total chlorine
C. Free chlorine F. None of the Above

234. Total chlorine residual = free +_____.
A. Chlorine residual D. Combined chlorine residual
B. Chlorine demand E. Total chlorine residual
C. Free chlorine F. None of the Above

Hydraulic Principles Section
235. Hydraulics can be divided into two areas, _____ and hydrokinetics.
A. Fluids D. Mechanical properties of water
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

236. Which of the following terms includes the behavior of all liquids, although it is primarily concerned with the motion of liquids.
A. Fluids D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

237. _____ includes the manner in which liquids act in tanks and pipes, deals with their properties, and explores ways to take advantage of these properties.
A. Pressure D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

238. Which of the following terms includes the consideration of liquids at rest, involves problems of buoyancy and flotation?
A. Pressure D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

239. _____ includes the study of liquids in motion, is concerned with such matters as friction and turbulence generated in pipes by flowing liquids.
A. Pressure D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

240. Which of the following terms is about the pressures exerted by a fluid at rest?
A. Pressure D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

241. Which of the following terms is an excellent example of deductive mathematical physics, and in which the predictions agree closely with experiment?
A. Pressure D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

242. Which of the following terms is usually stated that in a fluid is a substance that cannot resist a shearing stress, so that pressures are normal to confining surfaces?
A. Pressure D. Hydraulics
B. Hydrostatics E. Flow
C. Hydrokinetics F. None of the Above

Barometric Loop
243. According to the text, the barometric loop, will provide protection against backsiphonage, is based upon the principle that a water column, at sea level pressure, will not rise above 33.9 feet. In general, barometric loops are locally fabricated, and are 35 feet high.
A. True B. False

244. Which of the following terms could be measured an absolute scale, pounds per square inch absolute (psia), or gauge scale, (psiag).
A. Static pressure D. Sea level
B. Pressure E. Atmospheric pressure
C. Gauge pressure F. None of the Above

245. Absolute pressure is equal to gauge pressure plus the atmospheric pressure.
A. True B. False

246. According to the text, absolute pressure and gauge pressure?
A. Are the same D. That effectively protects
B. Referred to using pressure E. Permanent forces tangential
C. Are related F. None of the Above

247. Which of the following terms at sea level is 14.7 psai?
A. Static pressure D. Sea level
B. Pressure E. Atmospheric pressure
C. Gauge pressure F. None of the Above

248. Which of the following terms is the total pressure?
A. Static pressure D. Sea level
B. Absolute pressure E. Atmospheric pressure
C. Gauge pressure F. None of the Above

249. Gauge pressure is simply the pressure read on the gauge. If there is no pressure on the gauge other than atmospheric, the gauge will read zero.
A. True B. False

Pump Definitions
250. Which of the following definitions is a barrier that separates stages of a multi-stage pump?
A. Gasket D. Inter-stage diaphragm
B. Keyway E. Seal
C. Bearing F. None of the Above

251. _____ is a flat material that is compressed between two flanges to form a seal?
A. Gasket D. Seal
B. Keyway E. Bond
C. Packing F. None of the Above

252. Which of the following definitions is a line that directs sealing fluid to the stuffing box?
A. Leak-off D. Lantern ring
B. Gland sealing line E. Gland follower
C. Horizontal line F. None of the Above

253. _____ is the part of the pump that increases the speed of the fluid being handled?
A. Packing D. Seal
B. Impeller E. Outboard
C. Inboard F. None of the Above

Pumps
254. Pumps are excellent examples of?
A. Hydrostatics D. Multi-stage pumps
B. Quasi-static E. Complicated part
C. Oscillating diaphragm F. None of the Above

255. Pumps are of two general types, _____ or positive displacement pumps, and pumps depending on dynamic forces, such as centrifugal pumps.
A. Hydrostatic D. Hydrostatic considerations
B. Quasi-static E. Complicated part
C. Oscillating diaphragm F. None of the Above

256. Positive displacement pumps have a piston moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.
A. True B. False

257. More complicated pumps have valves check valves that open to allow _____, and close automatically to prevent reverse flow.
A. Pistons D. Passage in one direction
B. Diaphragms E. Lift pumps
C. Discharged fluid F. None of the Above

258. There are many kinds of_____, and can be the most trouble-prone and complicated part of a pump.
A. Rotors D. Air space
B. Force pumps E. Valves
C. Inlets F. None of the Above

259. According to the text, the force pump has _____in the cylinder, one for supply and the other for delivery.
A. Two check valves D. Cylinders
B. Diaphragms E. Lift pumps
C. Rotors F. None of the Above

260. The supply valve opens when the cylinder_____, the delivery valve when the cylinder volume decreases.
A. Rotor
B. Force pump
C. Volume decreases
D. Air space
E. Volume increases
F. None of the Above

261. According to the text, the lift pump has a _____and a valve in the piston that allows the liquid to pass around it when the volume of the cylinder is reduced.
A. Supply valve
B. Diaphragm
C. Discharged fluid
D. Cylinder
E. Lift pumps
F. None of the Above

Pump Categories
262. Pump operation like with a centrifugal pump — pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called?
A. Inward force
B. Head
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

263. According to the text, pumps may be classified upon the basis of the application they serve.
A. True
B. False

264. According to the text, all pumps may be divided into two major categories: (1) dynamic and (2)?
A. Centrifugal
B. Impeller
C. Displacement
D. Diaphragm
E. Rotary
F. None of the Above

Basic Water Pump
265. According to the text, the centrifugal pumps work by spinning water around in a circle inside a?
A. Vortex
B. Cylinder
C. Viscous drag pump
D. Center of the impeller
E. Cylindrical pump housing
F. None of the Above

266. The pump makes the water spin by pulling it with an impeller.
A. True
B. False

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

268. In a centrifugal pump, the water pressure at the edge of the turning impeller rises until it is able to keep water circling with the?
A. Centrifugal pump(s)
B. Impeller blade(s)
C. Bernoulli's equation
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

269. In a centrifugal pump, as water drifts outward between the _____ of the pump, it must move faster and faster because its circular path is getting larger and larger.
A. Centrifugal pump(s)
B. Impeller blade(s)
C. Bernoulli's equation
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

270. As the water slows down and its kinetic energy decreases, that water's pressure potential energy increases.
A. True B. False

271. As the water spins, the pressure near the outer edge of the pump housing becomes much lower than near the center of the impeller.
A. True B. False

272. The impeller blades cause the water to move faster and faster.
A. True B. False

273. The impellers may be of either a semi-open or closed type.
A. True B. False

274. According to the text, without an inward force, an object will travel in a straight line and will not complete the?
A. Circle D. Center of the impeller
B. Pump pushes E. Incompressible fluid
C. Viscous drag pump F. None of the Above

275. In a centrifugal pump, the inward force is provided by high-pressure water near the outer edge of the _____.
A. Centrifugal pump(s) D. Diaphragm pump(s)
B. Impeller blade(s) E. Cylindrical pump housing
C. Pump housing F. None of the Above

276. 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 D. Center of the impeller
B. Pump pushes E. Incompressible fluid
C. Viscous drag pump F. None of the Above

277. In the operation of the pump, when water is actively flowing through the pump, arriving through a hole near the center of the impeller and leaving through a _____ near the outer edge of the pump housing, the pressure rise between center and edge of the pump is not as large.
A. Centrifugal pump(s) D. Diaphragm pump(s)
B. Impeller blade(s) E. Cylindrical pump housing
C. Hole F. None of the Above

Types of Water Pumps
278. Vertical turbine pumps are commonly used in groundwater production. These pumps are driven by a shaft rotated by a motor on the surface.
A. True B. False

279. The shaft turns the impellers within the pump housing while the?
A. Spider bearing(s) D. Water moves up the column
B. Horsepower turns the shaft E. Desired pumping rate is obtained
C. Impeller(s) F. None of the Above

280. The rotating shaft in a line shaft turbine is actually housed within the column pipe that delivers the water to the surface.
A. True B. False

281. The size of the _____are selected based on the desired pumping rate and lift requirements.
A. Spider bearing(s) D. Column, impeller, and bowls
B. Horsepower E. Desired pumping rate
C. Impeller(s) F. None of the Above

282. According to the text, column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by?
A. Oil tube D. Single or multiple bowls
B. Spider bearings E. Pump's lifting capacity
C. Column pipe F. None of the Above

283. The water passing through the column pipe serves as the lubricant for the bearings.
A. True B. False

284. Which of the following terms, provide both a seal at the column pipe joints and keep the shaft aligned within the column?
A. Spider bearing(s) D. Roller bearings
B. Keyway E. Lantern rings
C. Impeller(s) F. None of the Above

285. Some vertical turbines are lubricated by oil rather than water. These pumps are essentially the same as_____; only the drive shaft is enclosed within an oil tube.
A. Oil tube D. Single or multiple bowls
B. Water lubricated units E. Pump's lifting capacity
C. Column pipe F. None of the Above

286. The oil tube is suspended within the column by_____, while the line shaft is supported within the oil tube by brass or redwood bearings.
A. Oil tube D. Single or multiple bowls
B. Spider flanges E. Pump's lifting capacity
C. Column pipe F. None of the Above

287. A continuous supply of _____the drive shaft as it proceeds downward through the oil tube.
A. Spider bearing(s) D. Turbine pump(s)
B. Oil lubricates E. Desired pumping rate
C. Impeller(s) F. None of the Above

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

289. According to the text, suction lift is when the level of water to be pumped is below the?
A. Impeller D. Centerline of the pump
B. Suction E. Bellows
C. Lift water F. None of the Above

290. According to the text, the ability of the pump to lift water is the result of a partial vacuum created at the?
A. Partial vacuum D. Pressure differential
B. Suction lift E. Negative suction head
C. Center of the pump F. None of the Above

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

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

Centrifugal pumps are classified into three general categories:
293. Which of the following terms is a centrifugal pump in which the pressure is developed wholly by centrifugal force?
A. Cylinder D. Cavity
B. Chamber E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

294. _____ is a centrifugal pump in which the pressure is developed partly by centrifugal force and partly by the lift of the vanes of the impeller on the liquid?
A. Plunger pump D. Discharge tube
B. Mixed flow E. Roots blower
C. Dynamic F. None of the Above

295. Which of the following terms is a centrifugal pump in which the pressure is developed by the propelling or lifting action of the vanes of the impeller on the liquid?
A. Axial flow D. Cavity
B. Chamber E. Positive displacement pump(s)
C. Radial flow F. None of the Above

Key Pump Words
296. Which of the following key terms is a measure of a liquid's resistance to flow. i.e.: how thick it is?
A. NPSH D. S.G.: Specific gravity
B. Specific Speed E. Vapor Pressure
C. Viscosity F. None of the Above

297. _____ determines the type of pump used, the speed it can run at, and with gear pumps, the internal clearances required.
A. NPSH D. S.G.: Specific gravity
B. Specific Speed E. Vapor Pressure
C. Viscosity F. None of the Above

298. Which of the following key terms is the amount of pressure / head required to 'force' liquid through pipe and fittings?

A. NPSH
B. Specific Speed
C. Viscosity
D. Friction Loss
E. Vapor Pressure
F. None of the Above

299. Which of the following key terms is related to how much suction lift a pump can achieve by creating a partial vacuum?

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above

300. _____ is related to how a liquid is greater than the surrounding air pressure, the liquid will boil.

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above