

Registration form

**GROUNDWATER PRODUCTION \$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

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

Address _____

City _____ **State** _____ **Zip** _____

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Phone:
Home (_____) _____ **Work (_____)** _____

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

Your certificate will be mailed to you in about two weeks.
Please circle/check which certification you are applying the course CEU's.
Water Treatment ___ Water Distribution ___ Other _____

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We will stop mailing the certificate of completion so we need your e-mail address. We will e-mail the certificate to you, if no e-mail address; we will mail it to you.

DISCLAIMER NOTICE

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

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/PDF/CEU%20State%20Approvals.pdf>

You can obtain a printed version of the course manual from TLC for an additional \$79.95 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.

GROUNDWATER PRODUCTION Answer Key

Name _____

Phone _____

Please Circle, Bold, Underline or X, one answer per question.

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Please fax the answer key to TLC Western Campus Fax (928) 272-0747
Backup Fax (928) 468-0675 Always call us after faxing the paperwork to ensure that we've received it.

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

**GROUNDWATER PRODUCTION 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.

1. Please rate the difficulty of your course.
Very Easy 0 1 2 3 4 5 Very Difficult
2. Please rate the difficulty of the testing process.
Very Easy 0 1 2 3 4 5 Very Difficult
3. Please rate the subject matter on the exam to your actual field or work.
Very Similar 0 1 2 3 4 5 Very Different
4. How did you hear about this Course? _____
5. What would you do to improve the Course?

How about the price of the course?

Poor _____ Fair _____ Average _____ Good _____ Great _____

How was your customer service?

Poor _____ Fair _____ Average _____ Good _____ Great _____

Any other concerns or comments.

Groundwater Production CEU Training Course Assignment

The Groundwater Production 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. All answers will come exactly from the course manual. Call us if you need assistance.

Please e-mail or fax your answers and registration forms to TLC.

1. The term "aquifer" literally means?
 - A. Porosity
 - B. Permeability
 - C. Confined and Unconfined
 - D. Water bearer
 - E. None of the Above

2. Basically, there are two kinds of aquifers:
 - A. Water bearer & Aquifer
 - B. Porosity & Permeability
 - C. Confined and Unconfined
 - D. Underground Lakes and Rivers
 - E. None of the Above

3. Confined aquifers are frequently found at greater depths than unconfined aquifers. In contrast, unconfined aquifers are not sandwiched between these layers of relatively impermeable materials, and their upper boundaries are generally?
 - A. Based in part on the size of these spaces and the extent to which they are connected.
 - B. Closer to the surface of the land
 - C. Relative to the amount of open space present to hold water. Its ability to transmit water.
 - D. None of the Above

4. If the aquifer is sandwiched between layers of relatively impermeable materials (e.g., clay), it is called?
 - A. Water bearer & Aquifer
 - B. Porosity & Permeability
 - C. Confined
 - D. Unconfined
 - E. None of the Above

5. Which type of aquifer is frequently found at greater depths?
 - A. Confined
 - B. Unconfined
 - C. Does not matter
 - D. None of the Above

There are no intentional trick questions.

6. Unconfined aquifers are not sandwiched between layers of relatively impermeable materials, and their upper boundaries are generally?
- A. Near Cracks or Fractures
 - B. Have more Permeability
 - C. Further from the surface of the land
 - D. Closer to the surface of the land
 - E. None of the Above
7. The level below which all the spaces are filled with water is called the?
- A. Water table
 - B. Unsaturated zone
 - C. Soil moisture
 - D. Saturated zone
 - E. None of the Above
8. Above the water table lies the?
- A. Unsaturated zone
 - B. Water table
 - C. Soil moisture
 - D. Saturated zone
 - E. None of the Above
9. The spaces in the rock and soil contain both air and water. Water in this zone is called?
- A. Unsaturated zone
 - B. Water table
 - C. Soil moisture
 - D. Saturated zone
 - E. None of the Above
10. The entire region below the water table is called the saturated zone, and water in this saturated zone is called?
- A. Unsaturated zone
 - B. Soil moisture
 - C. Saturated zone
 - D. Groundwater
 - E. None of the Above
11. Groundwater usually flows downhill with the slope of the?
- A. Unsaturated zone
 - B. Soil moisture
 - C. Water table
 - D. Groundwater
 - E. None of the Above
12. Groundwater may move in _____ directions below the ground than the water flowing on the surface.
- A. The same
 - B. Different
 - C. Downward
 - D. Upward
 - E. None of the Above

13. The movement of water from an aquifer into a well results in the formation of?
- A. Unsaturated zone
 - B. Soil moisture
 - C. Saturated zone
 - D. A cone of depression
 - E. None of the Above
14. _____ 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. Backflow
 - B. Piezometric surface
 - C. Drawdown
 - D. A cone of depression
 - E. None of the Above
15. _____ are those that are bounded by the water table. Some aquifers, however, lie beneath layers of impermeable materials.
- A. Piezometric surface
 - B. Unconfined aquifers
 - C. Drawdown
 - D. A cone of depression
 - E. None of the Above
16. The pressure within the aquifer results in a water level rising above the aquifer to the?
- A. Piezometric surface
 - B. Foot
 - C. Drawdown
 - D. A cone of depression
 - E. None of the Above
17. Sometimes confined aquifers may be _____. These are confined aquifers that have pressures high enough to raise water levels above the upper extent of the aquifer.
- A. Artesian aquifers
 - B. Piezometric surface
 - C. Artesian well
 - D. A cone of depression
 - E. None of the Above
18. Occasionally, groundwater may flow naturally from a well constructed in these type of aquifers resulting in a ?
- A. Artesian aquifers
 - B. Piezometric surface
 - C. Artesian well
 - D. A cone of depression
 - E. None of the Above
19. _____ are rocks in which the groundwater moves through cracks, joints or fractures in otherwise solid rock.
- A. Basalt
 - B. Fractured aquifers
 - C. Limestones
 - D. Dissolution
 - E. None of the Above

20. Examples of aquifers formed by the _____ of solid rock include granite and basalt aquifers.
- A. Basalt
 - B. Fractured aquifers
 - C. Faulting
 - D. Dissolution
 - E. None of the Above
21. Limestones are often fractured aquifers, but here the cracks and fractures may be enlarged by _____, forming large channels or even caverns.
- A. Basalt
 - B. Fractured aquifers
 - C. Limestones
 - D. Dissolution
 - E. None of the Above
22. Limestone terrain where solution has been very active is termed?
- A. Karst
 - B. Fractured aquifers
 - C. Limestones
 - D. Dissolution
 - E. None of the Above
23. Porous media such as sandstone may become so highly cemented or re-crystallized that all of the original space is filled. In this case, the rock is no longer a porous medium. However, if it contains cracks it can still act as a?
- A. Karst
 - B. Fractured aquifers
 - C. Limestones
 - D. Dissolution
 - E. None of the Above
24. Most of the aquifers of importance to us are _____ porous media such as sand and gravel. Some very porous materials are not permeable. Clay, for instance, has many spaces between its grains, but the spaces are not large enough to permit free movement of water.
- A. Karst
 - B. Fractured aquifers
 - C. Limestones
 - D. Unconsolidated
 - E. None of the Above
25. Drilling fluids are often used during drilling in order to keep the _____ open while drilling is done. Drilling fluids stabilize the hole and aid in the removal of cuttings. Typical drilling fluids may be water, mud, air, chemical or natural additives, or combinations of each.
- A. Shaft
 - B. Borehole
 - C. Excavation
 - D. Trench
 - E. None of the Above
26. Air rotary with down hole hammer is particularly suited for _____ drilling.
- A. Sediment
 - B. Hard Rock
 - C. Type C Soil
 - D. Alluvial
 - E. All of the above

27. Mud rotary is better suited for drilling in _____. No matter what type of rig or method is being used a highly trained and skilled driller is required to operate them successfully.

- A. Sediment
- B. Hard Rock
- C. Type C Soil
- D. Alluvial
- E. All of the above

28. _____ utilizes a drilling rig with a rotating bit and circulating drilling fluid to penetrate into the aquifer. It is the most common type of drilling method used today. Common variations of this method include direct and reverse mud rotary, direct air rotary, and drill through casing driver methods.

- A. Direct rotary
- B. Rotary drilling
- C. Kelly
- D. All of the above
- E. None of the Above

29. _____ uses a drill string that typically consists of a bit, collar, drill pipe and a kelly (if table driven).

- A. Direct rotary
- B. Rotary drilling
- C. Kelly
- D. Drag
- E. All of the above

30. A _____ is a section of heavy walled pipe that can be hexagonal, square, or rounded with grooves.

- A. Direct rotary
- B. Rotary drilling
- C. Kelly
- D. Drag
- E. None of the Above

31. The _____ turns the kelly and the rest of the drill string connected below as it slips down through the table.

- A. Sub
- B. Drive unit
- C. Top drive
- D. Table drive
- E. None of the Above

32. Some rotary rigs use a _____ to turn the drill string and is much like a drill press, but much larger.

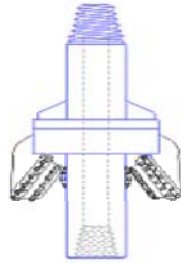
- A. Sub
- B. Drive unit
- C. Top drive
- D. Table drive
- E. None of the Above

33. A top drive is free to move up and down the _____ of the rig while rotating the drill string.
- A. Tri-cone bit
 - B. Mast
 - C. Top drive
 - D. Table drive
 - E. None of the Above
34. Drill pipe can be used in various lengths but are typically 20-foot sections and may be connected to the drive unit with a _____.
- A. Tri-cone bit
 - B. Drive unit
 - C. Top drive
 - D. Table drive
 - E. None of the Above
35. Roller bits, such as the common _____, typically utilize interlocking teeth or buttons on individual rotating cones to cut, crush, or chip through the formation.
- A. Tri-cone bit
 - B. Drive unit
 - C. Top drive
 - D. Table drive
 - E. None of the Above
36. _____ are also aided by the jetting of drilling fluids from nozzles or jets in the bit.
- A. Roller bits
 - B. Under reaming
 - C. Reamers
 - D. Carbide buttons
 - E. None of the Above
37. These bits can be used in consolidated formations and even hard rock applications if equipped with _____.
- A. Roller bits
 - B. Under reaming
 - C. Reamers
 - D. Carbide buttons
 - E. None of the Above
38. _____ are bits that can be used to enlarge, straighten, or clean an existing borehole.
- A. Roller bits
 - B. Under reaming
 - C. Reamers
 - D. Carbide buttons
 - E. None of the Above
39. _____ involves the projection of cutting blades beneath permanently installed casing in loosely consolidated sediments. This can allow for the cost effective installation of well screen and gravel pack within deeper loosely consolidated aquifers.
- A. Roller bits
 - B. Under reaming
 - C. Reamers
 - D. Carbide buttons
 - E. None of the Above

Identify the following pictures

40.

- A. Reamer
- B. Tricone Roller Bits
- C. Roller Reamer
- D. Drag Bit
- E. Percussion Bits



41.

- A. Reamer
- B. Tricone Roller Bits
- C. Roller Reamer
- D. Drag Bit
- E. Percussion Bits



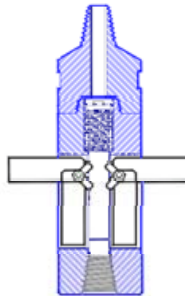
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- A. Reamer
- B. Tricone Roller Bits
- C. Roller Reamer
- D. Drag Bit
- E. Sand Bailer



43.

- A. Reamer
- B. Tricone Roller Bits
- C. Roller Reamer
- D. Drag Bit
- E. Drag Type Under-reamer



44.

- A. Over the Hammer Stabilizer
- B. Tricone Roller Bits
- C. Roller Reamer
- D. Drag Bit
- E. Percussion Bits



45. 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

46. The drilling fluid that is pumped by the rigs mud pump and/or air compressor is jetted out of ports in the bit. These ports are called kellys.

- A. True
- B. False

47. 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. The drilling fluid cools the borehole and helps to keep the water clean while removing cuttings.

- A. True
- B. False

48. Large drill rigs may utilize cuttings containment systems that separate the cuttings from the drilling fluid before a pickup pump recirculates the drilling fluid back down the borehole, were the process is then done in the reverse order. Also, one or more temporary mud pits may be dug into the ground adjacent to the rig in order to contain and settle out cuttings from the drilling fluid before recirculating.

- A. True
- B. False

49. Direct transient rotary drilling rigs use various types of mud or drilling fluid to drill into the ground. Mud is circulated down the drill string and through the bit at the top of the borehole.

- A. True
- B. False

50. The process of building up a film of mud on the borehole walls is important to mud rotary drilling and is called mud caking. Sometimes specially trained personnel are needed to manage the physical properties of the mud to ensure that a proper mud cake thickness is maintained and that a proper density or weight of mud is used to efficiently drill the well.

- A. True
- B. False

51. The mud engineer will often use bentonite clay and soap to make the mud drilling fluid. Sometimes chemical additives such as oxidizers and caustics may be used. Mud engineers play an important role in ensuring that a mud rotary drilled well can be drilled to the proper depths successfully and ultimately developed for use.

- A. True
- B. False

52. Sometimes the loss of mud drilling fluids to cavities in the earth cannot be stopped with a mud cake alone however. In these instances, casing or grout may be installed to permit drilling beyond such zones.

- A. True
- B. False

53. Mud rotary methods utilize compressed air and derived drill cuttings and groundwater as the drilling fluid. Mud is forced through the drill string and out the bit where it then mixes with and lifts cuttings and any derived groundwater to the surface. Once at the surface, the cuttings and groundwater are typically contained in subsurface pits, much like the mud rotary method.

- A. True
- B. False

54. Biodegradable foam or surfactant (soap) is often added while drilling with air in order to maintain sufficient hole pressurization so that cuttings may be lifted to the surface efficiently while maintaining hole stability.

- A. True
- B. False

55. The air rotary method is particularly suitable to hard rock drilling with a down hole air hammer. The air hammer utilizes compressed air to drive a piston up and down which makes the hammer bit move up and down while the drill string rotates. The combined rotating and hammering action generates great rock breaking force and is very valuable for drilling through solid rock or consolidated formations.

- A. True
- B. False

56. Conventional air rotary drilling methods utilize roller bits in the same way as those used for mud rotary drilling. In hard rock or consolidated formations a roller button bit may be used when drilling pressures are too high or borehole sizes are too large for the efficient operation of an air hammer.

- A. True
- B. False

57. Auger boring methods make use of a rotating blade or spiral flange that may be attached to a pilot bit and cutter head. Down-force applied by the rig along with the rotating action of the blade and cutting action of the pilot and/or cutter bits facilitates the boring process.

- A. True
- B. False

58. Augers are capable of boring large diameter holes in excess of four feet in diameter. They are typically used in shallow applications (less than 200 feet) and where stable silt and clay soils or soft materials are dominant.

- A. True
- B. False

59. One of the methods is commonly used in environmental applications for the collection soil samples. There are three primary types of auger boring methods: rotary stem, bucket, and butterfly.

- A. True
- B. False

60. The solid stem auger boring method uses a spiral flanged drill pipe driven by either a globe or rotary drive head like those used on dayton rigs. The drill pipe may be continuously flanged or just the initial section is welded.

- A. True
- B. False

61. Welded sections of drill pipe are referred to as flighting.

- A. True
- B. False

62. Larger diameter augers typically employ a single flight and can be used in stable formations to depths of approximately 600 feet.

- A. True
- B. False

63. Samples may be collected from these cuttings or the flighting may be brought to the surface and samples collected from the cutting head. This method is not suited for applications below the water table and may provide limited soil sample data. However, it may be used to aid in quickly constructing the larger diameter upper sections for larger wells.

- A. True
- B. False

64. The globe auger method essentially combines the rotary and auger techniques.

- A. True
- B. False

65. The Bucket auger method employs a single, typically large in diameter, bucket auger to drill or bore into the ground. The bucket auger is a cylinder constructed with auger like blades at its bottom edge. These blades may be armored with various forms of cutting teeth or blades to provide strength and "bite".

- A. True
- B. False

66. The bucket auger is rotated via a kelly and table drive much like those of rotary rigs.

- A. True
- B. False

67. Bucket auger rigs utilize a telescoping kelly.

- A. True
- B. False

68. This type of kelly allows the rig to drill to depths of 4,000 feet or more without requiring the addition and removal of drill pipe. When the bucket is filled with cuttings it is closed and brought to the surface where it is swung out to the side of the rig by a specially designed swing arm or dumping arm. At this point the bucket is closed and cuttings are dumped. Soil samples may then be collected and can be considered representative of section bored.

- A. True
- B. False

69. Bucket auger methods typically cannot be used in material containing cobbles and boulders, but is used most often in more stable semi consolidated silty or clay rich deposits. Large diameter wells up to 4 feet in diameter may be constructed with the bucket auger method with smaller diameters approaching 200 feet in depth. Occasionally drilling fluids such as bentonite mud, may be used in order to maintain borehole stability when drilling in questionable materials.

- A. True
- B. False

70. The cable tool or percussion method is one of the oldest and most reliable forms of well drilling still used today. This method is adaptable to virtually every kind of drilling environment. As a result, numerous variations in both rig types and methods have evolved over its history. However, it is often used as a method of last resort when time is an issue, due to its typically slow process.

- A. True
- B. False

71. The cable tool method can surely succeed where any of the other methods fail.

- A. True
- B. False

72. Cable tool or percussion drilling methods utilize a system of cranes and cleaves to lift and drop a kelly string as downward progress is made. The weight and force of the kelly impact breaks up the ground and permits a typically slow, but steady, downward movement.

- A. True
- B. False

73. Water is used as the primary drilling fluid. As drilling proceeds, cuttings and water mix forming a slurry. This slurry is allowed to pass back and forth through a water course or opening within the drill string. The drill string is welded to the shaft to prevent theft.

- A. True
- B. False

74. A bailer is a section of pipe constructed with a pressure relief valve located at the bottom of the pipe. As the bailer is lowered it fills with the drilling fluid and cuttings. When the bailer is raised up, the PRV at the bottom of the pipe closes, trapping the slurry inside. The slurry can then be lifted to the surface and the contents dumped into a containment system where samples may then be collected.

- A. True
- B. False

75. The cable tool drill string is comprised of a cable, swivel socket, drilling jars, drill stem, and drill bit. The primary cable is used to lift and drop the drill string while the swivel socket provides a rotating mechanism. The rotation allowed by the swivel socket ensures that fresh cuts are made with each strike of the bit. The drilling jars are used only for additional upward shock to remove the bit should it become stuck in the borehole.

- A. True
- B. False

76. The drill stem provides the majority of the weight of the drill string and also helps to maintain a straight borehole. It serves the same purpose as does the drill collar used in rotary methods. Cable tool bits are normally a round shape, although numerous variations may be used for different formations, including iron and copper coated bits for consolidated formations.

- A. True
- B. False

77. The borehole may remain open or casing may be advanced while drilling, in order to keep the borehole open in unstable formations. Casing is advanced by either pushing it hydraulically, like a large press, or by driving it down with the drill string or a drive block.

- A. True
- B. False

78. The dayton is a heavy collar type device that attaches over the flex coupling and is lifted up and allowed to fall, striking the casing and forcing it down.

- A. True
- B. False

79. Drilling, casing advancement, and bailing alternate as the borehole gets progressively deeper. If the casing becomes too difficult to advance further and the required drill depth has yet to be achieved, a smaller borehole and casing may be used inside of the outer casing in order to continue. This is called "Walking".

- A. True
- B. False

80. All wells must be constructed with a mechanical seal to prevent the infiltration of surface water and/or surface contaminants into the well bore and aquifer.
A. True
B. False
81. This seal is installed in the below portions of the well bore between the annulus and surface casing and will normally extend to the ground surface around the well.
A. True
B. False
82. The seal is constructed by pouring or pumping neat cement grout and/or bentonite between the surface casing and the well bore.
A. True
B. False
83. The installation of the cement or grout between the annulus and surface casing effectively seals off the upper borehole from the surface.
A. True
B. False
84. The surface casing used 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. True
B. False
85. When the well was drilled into the aquifer the depths of water productive intervals and estimated well yield are normally logged by the driller or geologist.
A. True
B. False
86. Following the installation of the wells surface seal, the well is then reamed (if necessary) to accept additional blank casing, 90 bends, Street L's, and filter or gravel pack.
A. True
B. False
87. Once the well has been reamed large enough in diameter for the anticipated flow rate, the wells casing can be installed. The well casing ensures that the borehole remains open and that debris from the formation(s) do not enter the well, thereby protecting the pump equipment and well itself.
A. True
B. False
88. Blank casing is normally installed to the depth of the main producing zone. At this point well screen is used and may extend to the total depth of the well or may be used intermittently to total depth with blank casing used through unstable or non-productive areas.
A. True
B. False
89. As with casing, the choice of well screen is as important as its placement. The size of the openings in the casing (screen slot or perforated opening size) is dependent on the disinfectant used.
A. True
B. False

90. As a rule, coarse grained sediment or fractured aquifers may be naturally developed while fine-grained sediment aquifers typically require a filter pack. The selection of screen slot size is normally made based on samples collected from the aquifer during drilling and consideration of the filter or gravel pack grain-size.
- A. True
 - B. False
91. As a rule, wire wrapped screen or continuous screen is normally used in municipal applications where a low yield is obtained from unconsolidated to semi-consolidated formations.
- A. True
 - B. False
92. Slotted and perforated screens are stronger and more expensive than wire wrapped screens and are best suited to deep, where borehole stability is a concern, and in domestic applications.
- A. True
 - B. False
93. Louvered screen is used in high yield production wells but particularly where cascading water is a problem. The louvers deflect groundwater above pumping levels back into the annulus or filter pack so that air entrainment and corrosion within the well are minimized.
- A. True
 - B. False
94. Air entrainment occurs when cascading water rises into the pumping water level creating turbulence that makes bubbles. These bubbles may get drawn into a vortex created by the depth of the water.
- A. True
 - B. False
95. Once the casing and screen specifications are determined they may be installed into the well. Due to weight, casing is often installed with a drill rig. If a well is telescoped the driller will install the largest diameter portions first. Gravel or filter packs can then be installed.
- A. True
 - B. False
96. A bentonite or cement plug is often installed in the bottom of the borehole before the filter pack is installed. If certain intervals of the well need to be isolated from others, inflatable packers with bentonite or cement grout may be used.
- A. True
 - B. False
97. The kelly is used to seal off a portion of the annulus to prevent the movement of seal material into the filter pack. These types of seals are commonly used for wells constructed within confined aquifers so that they may remain isolated and avoid cross connection with other aquifers.
- A. True
 - B. False
98. Appropriate location of the well reduces the possibility of contamination.
- A. True
 - B. False

99. The ideal well location has good drainage and is higher than the surrounding ground surface. All possible sources of contamination 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 Code. Surface drainage should not allow surface water to accumulate within a 5-foot radius of the well. A well must never be located closer than 2 feet to sewers, 10 feet to septic tanks, or 25 feet to sewage seepage fields.

- A. True
- B. False

100. A well should be higher than the surrounding ground surface for good drainage. All possible sources of contamination 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 Code.

- A. True
- B. False

101. Surface water should not accumulate within a 15-foot radius of the well. A well must never be located closer than 10 feet to sewers, and 50 feet to septic tanks, or 75 feet to sewage seepage fields.

- A. True
- B. False

102. A bored well with a diameter of 3 feet, a total depth of 50 feet and a water depth of 30 feet, contains approximately 1,600 gallons of water.

- A. True
- B. False

103. Bored wells are usually constructed utilizing the buried slab method. With this method, the upper well casing shall extend to a depth of 10 feet or more below ground surface and be firmly imbedded in a uniformly tapered hole that is formed when the reinforced concrete buried slab is manufactured, or shall be connected to a pipe cast in the concrete slab.

- A. True
- B. False

104. For bored wells not finished with a buried slab, the concrete casing also ranges in diameter from 20 to 30 feet. The annular space between the excavation and the installed casing should be grouted with concrete that is at least 6 inches thick and poured without construction joints from a minimum of 100 feet below ground level to the ground surface.

- A. True
- B. False

105. A new, cleaned or repaired well normally contains contamination that could be present for weeks unless the well is thoroughly disinfected. This can be accomplished by the use of ordinary liquid laundry bleach (unscented) in a solution concentration of 1,000 parts per million (ppm) of chlorine. The amount of bleach required is determined by the amount of water in the well.

- A. True
- B. False

106. Amount of bleach (5.25% chlorine) required for each 100 gallons of water equals 3 cups. One equals 8 ounces, 2 cups equal 1 pint, and 4 cups equal 1 quart.

- A. True
- B. False

107. Water system demand comes from a number of sources including residential, commercial, industrial and public consumers as well as some unavoidable loss and waste. If fire protection is desired, that could also represent a rather significant (although not continuous) demand upon the system.

- A. True
- B. False

108. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for headloss at all times.

- A. True
- B. False

109. The quantity of water used in any community varies from 50 to 500 gallons per person per day. A common design assumption is to use from 100 to 150 gallons per person per day for average domestic use.

- A. True
- B. False

110. The maximum daily use is approximately 6 to 7 times the average daily use. Maximum daily use is usually encountered during the summer months and can vary widely depending on irrigation practices.

- A. True
- B. False

111. When a well is installed in an confined aquifer, 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 top of the well. The level of the water in the well is the same as the water level in the aquifer.

Groundwater continues to flow through and around the well in one direction in response to gravity.

- A. True
- B. False

112. When abandoned wells are left open, children, animals or even adults can fall into them, causing injury or death. To prevent such accidents, all abandoned wells must be properly sealed.

- A. True
- B. False

113. If improperly sealed, an abandoned well can serve as a route for contaminating groundwater. Contaminated surface water, agricultural runoff and effluent from private sewage disposal systems can enter the groundwater through such wells and cause pollution of other wells in the area used for drinking water.

- A. True
- B. False

114. Wells should not be located within vaults or pits, except with a variance permit.

- A. True
- B. False

Microorganisms, this section is mixed with the water quality, bacteriological and microorganism appendix. We need for you to know the pathogens.

115. _____ are around 10–50 micrometer, but can grow up to 1 mm and can easily be seen under a microscope.

- A. Protozoa
- B. Microfungi
- C. Micro- and meiofauna
- D. Cysts
- E. None of the Above

116. Protozoa occupy a range of trophic levels. As predators, they prey upon unicellular or filamentous algae, bacteria, and _____.

- A. Protozoa
- B. Microfungi
- C. Micro- and meiofauna
- D. Cysts
- E. None of the Above

117. Protozoa also play a vital role in controlling bacteria populations and biomass. As components of the _____, protozoa are an important food source for microinvertebrates.

- A. Protozoa
- B. Micro- and meiofauna
- C. Microfungi
- D. Cysts
- E. None of the Above

118. As cysts, _____ can survive harsh conditions, such as exposure to extreme temperatures and harmful chemicals, or long periods without access to nutrients, water, or oxygen for a period of time.

- A. Protozoa
- B. Microfungi
- C. Micro- and meiofauna
- D. Cysts
- E. None of the Above

119. Being a cyst enables parasitic species to survive outside of the host, and allows their transmission from one host to another. When _____ are in the form of trophozoites (Greek, tropho=to nourish), they actively feed and grow.

- A. Protozoa
- B. Bacteria
- C. Micro- and meiofauna
- D. Cysts
- E. None of the Above

120. Giardiasis is a commonly reported protozoan-caused disease. It has also been referred to as “backpacker’s disease” and “beaver fever” because of the many cases reported among hikers and others who consume untreated surface water. _____ include chronic diarrhea, abdominal cramps, bloating, frequent loose and pale greasy stools, fatigue and weight loss.

- A. Giardia lamblia
- B. Giardia trophozoites
- C. Spore-forming bacteria
- D. Cysts
- E. None of the Above

121. _____ occurs worldwide. Waterborne outbreaks in the United States occur most often in communities receiving their drinking water from streams or rivers without adequate disinfection or a filtration system.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Giardiasis
 - D. Cysts
 - E. None of the Above
122. The organism, _____, has been responsible for more community-wide outbreaks of disease in the U.S. than any other pathogen. Drugs are available for treatment, but these are not 100% effective.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Spore-forming bacteria
 - D. Cysts
 - E. None of the Above
123. The ecological role of protozoa in the transfer of bacterial and algal production to successive trophic levels is important. Protozoa such as the malaria parasites (*Plasmodium* spp.), _____ and leishmania are also important as parasites and symbionts of multicellular animals.
- A. Trypanosomes
 - B. Microfungi
 - C. Micro- and meiofauna
 - D. Cysts
 - E. None of the Above
124. Most protozoa exist in 5 stages of life which are in the form of _____ and cysts.
- A. Protozoa
 - B. Microfungi
 - C. Trophozoites
 - D. Cysts
 - E. None of the Above
125. _____ is an example of a protozoan disease that is common worldwide, but was only recently recognized as causing human disease. The major symptom in humans is diarrhea, which may be profuse and watery.
- A. Oocysts
 - B. Cryptosporidiosis
 - C. Cryptosporidium
 - D. Cyst(s)
 - E. None of the Above
126. The _____ is associated with cramping abdominal pain. General malaise, fever, anorexia, nausea and vomiting occur less often. Symptoms usually come and go, and end in fewer than 30 days in most cases. The incubation period is 1-12 days, with an average of about seven days.
- A. Oocysts
 - B. Cryptosporidiosis
 - C. Cryptosporidium
 - D. Cyst(s)
 - E. None of the Above

127. _____ organisms have been identified in human fecal specimens from more than 50 countries on six continents.

- A. Giardia lamblia
- B. Giardia trophozoites
- C. Cryptosporidium
- D. Cysts
- E. None of the Above

128. The mode of transmission is fecal-oral, either by person-to-person or animal-to-person. There is no specific treatment for Cryptosporidium infections. All these diseases, with the exception of _____, have one symptom in common: diarrhea.

- A. Giardia trophozoites
- B. Cryptosporidiosis
- C. Cryptosporidium
- D. Hepatitis A
- E. None of the Above

129. They also have the same mode of transmission, fecal-oral, whether through person-to-person or animal-to-person contact, and the _____, being either foodborne or waterborne.

- A. Same routes of transmission
- B. Self-limiting disease
- C. The importance of properly constructed
- D. Cannot achieve sterile water (no microorganisms)
- E. None of the Above

130. Although most pathogens cause mild, self-limiting disease, on occasion, they can cause serious, even life threatening illness. _____ with weak immune systems, such as those with HIV infections or cancer.

- A. Particularly vulnerable are persons
- B. Determine the biological quality
- C. Provide adequate source protection and treatment
- D. All microorganisms
- E. None of the Above

131. By _____ of waterborne diseases, the importance of properly constructed, operated and maintained public water systems becomes obvious.

- A. Understanding the nature
- B. Determine the biological quality
- C. Providing adequate source protection and treatment
- D. The destruction of all microorganisms
- E. None of the Above

132. While water treatment _____ the goal of treatment must clearly be to produce drinking water that is as pathogen-free as possible at all times.

- A. Is synonymous with chlorination
- B. Determines the biological quality
- C. Provides adequate source protection and treatment
- D. Cannot achieve sterile water (no microorganisms)
- E. None of the Above

133. For those who operate water systems with inadequate source protection or treatment facilities, the _____.

- A. Potential risk of a waterborne disease outbreak is real
- B. Biological quality
- C. Adequate source protection and treatment
- D. Destruction of all microorganisms
- E. None of the Above

134. For those operating systems that currently _____, operating and maintaining the system at a high level on a continuing basis is critical to prevent disease.

- A. Synonymous with chlorination
- B. Determine the biological quality
- C. Provide adequate source protection and treatment
- D. Which is the destruction of all microorganisms
- E. None of the Above

135. Disinfection is usually synonymous with chlorination. That is because chlorine addition is by far the _____.

- A. Most common form of disinfection used today
- B. Biological quality
- C. Source protection and treatment
- D. Destruction of all microorganisms
- E. None of the Above

136. _____ is the process of killing microorganisms in water that might cause disease (pathogens).

- A. Chlorination
- B. Determining the biological quality
- C. Provide adequate source protection and treatment
- D. The destruction of all microorganisms
- E. None of the Above

137. Disinfection, however, _____, which is the destruction of all microorganisms. Disinfection is concerned only with killing pathogens.

- A. Is synonymous with chlorination
- B. Determines the biological quality
- C. Should not be confused with sterilization
- D. Is the destruction of all microorganisms
- E. None of the Above

Bacteriological Monitoring

138. Most waterborne diseases and illnesses have been related to the _____ of drinking water.

- A. Total coliforms
- B. Disease-causing microorganisms
- C. Coliform bacteria group
- D. Indicator bacteria
- E. None of the Above

139. The routine microbiological analysis of your water is for _____.

- A. Total coliforms
- B. Disease-causing microorganisms
- C. Coliform bacteria
- D. Indicator bacteria
- E. None of the Above

140. The _____ is used as an indicator organism to determine the biological quality of your water.
- A. Total coliforms
 - B. Disease-causing microorganisms
 - C. Coliform bacteria group
 - D. Indicator bacteria
 - E. None of the Above
141. The presence of an _____ or pathogenic bacteria in your drinking water is an important health concern. Indicator bacteria signal possible fecal contamination, and therefore the potential presence of pathogens.
- A. Total coliforms
 - B. Disease-causing microorganisms
 - C. Escherichia coli (E. coli)
 - D. Indicator
 - E. None of the Above
142. They are used to monitor for pathogens because of the difficulties in determining the presence of specific _____.
- A. Total coliforms
 - B. Disease-causing microorganisms
 - C. Escherichia coli (E. coli)
 - D. Indicator bacteria
 - E. None of the Above
143. _____ are usually harmless, occur in high densities in their natural environment, and are easily cultured in relatively simple bacteriological media.
- A. Total coliforms
 - B. Disease-causing microorganisms
 - C. Escherichia coli (E. coli)
 - D. Indicator bacteria
 - E. None of the Above
144. Indicators in common use today for routine monitoring of drinking water include _____, fecal coliforms, and Escherichia coli (E. coli).
- A. Total coliforms
 - B. Fecal coliforms
 - C. Escherichia coli (E. coli)
 - D. Cysts
 - E. None of the Above
145. Disease causing _____ (pathogens) have various structures that enhance their ability to cause illness. One important property is the ability to attach to the intended victim. pili, a proteinaceous surface structure on the bacteria, are critical in this process.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Bacteria
 - D. Cysts
 - E. None of the Above

146. Many _____ are capable of movement in their environment either by flagella or gliding motility. In the case of flagella, the bacteria have a long, flexible, spiral shaped structure, the flagellum that helps to push the microbe through solution.

- A. Giardia lamblia
- B. Giardia trophozoites
- C. Bacteria
- D. Cysts
- E. None of the Above

147. _____ also help in the detection of favorable or unfavorable conditions and move the bacteria in an appropriate direction.

- A. Oocysts
- B. Cryptosporidiosis
- C. Flagella
- D. Cyst(s)
- E. None of the Above

148. As a _____ grows it has to synthesize more of itself. Knowing what it is made of and how it is put together is critical to gain an understanding of the growth process.

- A. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

149. _____ are also capable of exchanging genetic information by mating. This process involves another type of surface structure, the F-pilus.

- A. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

150. Bacteria will take steps to insure their survival. This can take the form of creating _____ that allow the Bacteria to "sleep" during bad times.

- A. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

151. During abundant times, many _____ will store excess carbon, nitrogen, sulfur or phosphorous in inclusions in the cell.

- A. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

152. _____ forms an obvious slime on the inside of pipes and fixtures. A water test is not needed for identification. Check for a reddish-brown slime inside a toilet tank or where water stands for several days.

- A. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

153. _____ are common in the environment and are generally not harmful.

- A. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

154. The presence of these _____ in drinking water is 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. Bacteria
- B. Microbe(s)
- C. Iron bacteria
- D. Coliform bacteria
- E. None of the Above

Laboratory Procedures

The laboratory may perform the total coliform analysis in one of four methods approved by the U.S. EPA and your local environmental or health Division:

Methods

155. The MMO-MUG test--a product marketed as _____ is the most common. The sample results will be reported by the laboratories as simply coliforms present or absent. If coliforms are present, the laboratory will analyze the sample further to determine if these are fecal coliforms or E. coli and report their presence or absence.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

156. This type of sample _____ Samples collected on a routine basis to monitor for contamination. Collection should be in accordance with an approved sampling plan.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

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

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

158. This type of sample _____ Examples would be a sample collected after repairs to the system and before it is placed back into operation or a sample collected at a wellhead prior to a disinfection injection point.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

159. This type of sample _____ or sampling replaces the old check sampling with a more comprehensive procedure to try to identify problem areas in the system.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

160. Whenever a _____ sample is total coliform or fecal coliform present, a set of repeat samples must be collected within 24 hours after being notified by the laboratory. The follow-up for repeat sampling is:

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

161. If only one _____ sample per month or quarter is required, four (4) repeat samples must be collected.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

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

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

163. Repeat samples must be collected from: The _____ of the coliform present sample.

- A. Distribution system or at the wellhead
- B. Original sampling location
- C. POE
- D. At the pump
- E. None of the Above

164. Repeat samples must be collected from: Within five (5) service connections upstream from the _____.

- A. Distribution system or at the wellhead
- B. Original sampling location
- C. POE
- D. At the pump
- E. None of the Above

165. Repeat samples must be collected from: Within five (5) service connections downstream from the _____.

- A. Distribution system or at the wellhead
- B. Original sampling location
- C. POE
- D. At the pump
- E. None of the Above

166. Repeat samples must be collected from: Elsewhere in the _____, if necessary.

- A. Distribution system or at the wellhead
- B. Original sampling location
- C. POE
- D. At the pump
- E. None of the Above

167. If the system has only one service connection, the _____ samples must be collected from the same sampling location over a four-day period or on the same day.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

168. All _____ samples are included in the MCL compliance calculation.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

169. If a system which normally collects fewer than five (5) routine samples per month has a coliform present sample, it must collect five (5) _____ samples the following month or quarter regardless of whether an MCL violation occurred, or if repeat sampling was coliform absent.

- A. Colilert
- B. Routine
- C. Repeat
- D. Special
- E. None of the Above

170. The process by which the protozoa takes its cyst form is called encystation, while the process of transforming back into _____ is called excystation.

- A. Protozoa
- B. Microfungi
- C. Trophozoite
- D. Cysts
- E. None of the Above

171. _____ can reproduce by binary fission or multiple fission. Some protozoa reproduce sexually, some asexually, and some both (e.g. Coccidia). An individual protozoan is hermaphroditic.

- A. Protozoa
- B. Microfungi
- C. Virus(es)
- D. Cysts
- E. None of the Above

172. There are many ways that infectious diseases can spread. _____ usually have specific routes by which they are transmitted, and these routes may depend on the type of cells and tissue that a particular agent targets.

- A. Protozoa
- B. Giardia duodenalis
- C. Virus(es)
- D. Cysts
- E. None of the Above

173. Once in the air, the _____ can infect another person who is unlucky enough to inhale air containing the virus particles.

- A. Giardia lamblia
- B. Giardia trophozoites
- C. Virus(es)
- D. Cysts
- E. None of the Above

174. Agents vary greatly in their stability in the environment. Some viruses may survive for only a few minutes outside of a host, while some _____ are extremely durable and may survive in a dormant state for a decade or more.

- A. Giardia lamblia
- B. Giardia trophozoites
- C. Spore-forming bacteria
- D. Cysts
- E. None of the Above

175. Giardia lamblia (synonymous with Lamblia intestinalis and _____) is a flagellated protozoan parasite that colonizes and reproduces in the small intestine, causing giardiasis.

- A. Giardia lamblia
- B. Giardia trophozoites
- C. Amebiasis
- D. Giardia duodenalis
- E. None of the Above

176. The _____ attaches to the epithelium by a ventral adhesive disc, and reproduces via binary fission.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Giardia parasite
 - D. Amebiasis
 - E. None of the Above
177. _____ does not spread via the bloodstream, nor does it spread to other parts of the gastro-intestinal tract, but remains confined to the lumen of the small intestine.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Amebiasis
 - D. Giardiasis
 - E. None of the Above
178. _____ absorb their nutrients from the lumen of the small intestine, and are anaerobes.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Virus(es)
 - D. Cysts
 - E. None of the Above
179. _____ can occur through ingestion of dormant cysts in contaminated water, or by the fecal-oral route (through poor hygiene practices).
- A. Giardia lamblia
 - B. Giardia infection
 - C. Amebiasis
 - D. Cysts
 - E. None of the Above
180. The _____ can survive for weeks to months in cold water and therefore can be present in contaminated wells and water systems, and even clean-looking mountain streams, as well as city reservoirs, as the Giardia cysts are resistant to conventional water treatment methods, such as chlorination and ozonolysis.
- A. Giardia lamblia
 - B. Giardia trophozoites
 - C. Giardia cyst
 - D. Cysts
 - E. None of the Above
181. Zoonotic transmission is also possible, and therefore Giardia infection is a concern for people camping in the wilderness or swimming in contaminated streams or lakes, especially the artificial lakes formed by beaver dams (hence, the popular name for giardiasis, "_____").
- A. Giardia lamblia
 - B. Trophozoites
 - C. Cryptosporidium
 - D. Amebiasis
 - E. None of the Above

182. As well as _____, fecal-oral transmission can also occur, for example in day care centers, where children may have poorer hygiene practices.

- A. Giardia lamblia
- B. Trophozoites
- C. Cryptosporidium
- D. Cyst(s)
- E. None of the Above

183. Those who work with children are also at risk of being infected, as are family members of infected individuals. Not all _____ are symptomatic, so some people can unknowingly serve as carriers of the parasite.

- A. Giardia lamblia
- B. Trophozoites
- C. Giardia infections
- D. Cyst(s)
- E. None of the Above

184. The life cycle begins with a noninfective cyst being excreted with feces of an infected individual. Once out in the environment, the _____ becomes infective.

- A. Giardia lamblia
- B. Trophozoites
- C. Amebiasis
- D. Cyst(s)
- E. None of the Above

185. A distinguishing characteristic of the cyst is 4 nuclei and a retracted cytoplasm. Once ingested by a host, the trophozoite emerges to an active state of feeding and motility. After the feeding stage, the _____ undergoes asexual replication through longitudinal binary fission.

- A. Giardia lamblia
- B. Trophozoite
- C. Cryptosporidium
- D. Cyst(s)
- E. None of the Above

186. The resulting _____ then pass through the digestive system in the feces. While the trophozoites may be found in the feces, only the cysts are capable of surviving outside of the host.

- A. Giardia lamblia
- B. Trophozoites
- C. Trophozoites and cysts
- D. Cyst(s)
- E. None of the Above

187. Cryptosporidium is a protozoan pathogen of the Phylum Apicomplexa and causes a diarrheal illness called _____.

- A. Oocysts
- B. Cryptosporidiosis
- C. Cryptosporidium
- D. Cyst(s)
- E. None of the Above

188. Other _____ include the malaria parasite Plasmodium, and Toxoplasma, the causative agent of toxoplasmosis. Unlike Plasmodium, which transmits via a mosquito vector, Cryptosporidium does not utilize an insect vector and is capable of completing its life cycle within a single host, resulting in cyst stages which are excreted in feces and are capable of transmission to a new host.

- A. Oocysts
- B. Cryptosporidiosis
- C. Cryptosporidium
- D. Apicomplexan pathogens
- E. None of the Above

189. Cryptosporidiosis is typically an acute short-term infection but can become severe and non-resolving in children and immunocompromised individuals. The parasite is transmitted by environmentally hardy cysts (oocysts) that, once ingested, _____ in the small intestine and result in an infection of intestinal epithelial tissue.

- A. Oocysts
- B. Cryptosporidiosis
- C. Cryptosporidium
- D. Cyst(s)
- E. None of the Above

190. There have been six major outbreaks of _____ in the United States as a result of contamination of drinking water. One major outbreak in Milwaukee in 1993 affected over 400,000 persons. Outbreaks such as these usually result from drinking water taken from surface water sources such as lakes and rivers.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Cryptosporidium
- D. Cryptosporidial infection
- E. None of the Above

191. The highly environmentally resistant cyst of *C. parvum* allows the pathogen to survive various drinking water filtrations and chemical treatments such as chlorination. Although municipal drinking water utilities may meet federal standards for safety and quality of drinking water, complete protection from _____ is not guaranteed. In fact, all waterborne outbreaks of cryptosporidiosis have occurred in communities where the local utilities met all state and federal drinking water standards.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Cryptosporidium
- D. Cryptosporidial infection
- E. None of the Above

192. _____, another water-borne pathogen, can cause diarrhea or a more serious invasive liver abscess. When in contact with human cells, these amoebae are cytotoxic.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Entamoeba histolytica
- D. Cryptosporidial infection
- E. None of the Above

193. On average, about one in 10 people who are infected with _____ becomes sick from the infection. The symptoms often are quite mild and can include loose stools, stomach pain, and stomach cramping.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Entamoeba histolytica
- D. Cryptosporidial infection
- E. None of the Above

194. Amebic dysentery is a severe form of amebiasis associated with stomach pain, bloody stools, and fever. Rarely, _____ invades the liver and forms an abscess. Even less commonly, it spreads to other parts of the body, such as the lungs or brain.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Entamoeba histolytica
- D. Amebiasis
- E. None of the Above

195. _____ is a species of the rod-shaped bacterial genus Shigella. Shigella can cause shigellosis (bacillary dysentery).

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Entamoeba histolytica
- D. Shigella dysenteriae
- E. None of the Above

196. Shigellae are Gram-negative, non-spore-forming, facultatively anaerobic, _____.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Entamoeba histolytica
- D. Shigella dysenteriae
- E. None of the Above

197. _____, spread by contaminated water and food, causes the most severe dysentery because of its potent and deadly Shiga toxin, but other species may also be dysentery agents.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Entamoeba histolytica
- D. Shigella dysenteriae
- E. None of the Above

198. _____ is typically via ingestion (fecal–oral contamination); depending on age and condition of the host as few as ten bacterial cells can be enough to cause an infection.

- A. Giardia lamblia
- B. Cryptosporidiosis
- C. Shigella infection
- D. Shigella dysenteriae
- E. None of the Above

199. _____ cause dysentery that results in the destruction of the epithelial cells of the intestinal mucosa in the cecum and rectum.
- A. Giardia lamblia
 - B. Cryptosporidiosis
 - C. Entamoeba histolytica
 - D. Shigella
 - E. None of the Above
200. Some strains produce enterotoxin and Shiga toxin, similar to the _____.
- A. Giardia lamblia
 - B. Cryptosporidiosis
 - C. Verotoxin of E. coli O157:H7
 - D. Shigella dysenteriae
 - E. None of the Above
201. Both Shiga toxin and _____ are associated with causing hemolytic uremic syndrome.
- A. Giardia lamblia
 - B. Cryptosporidiosis
 - C. Verotoxin
 - D. Shigella dysenteriae
 - E. None of the Above
202. The most common symptoms are diarrhea, fever, nausea, vomiting, stomach cramps, and straining to have a bowel movement. The stool may contain blood, mucus, or pus (e.g. dysentery). In rare cases, young children may have _____.
- A. Giardia lamblia
 - B. Cryptosporidiosis
 - C. Entamoeba histolytica
 - D. Shigella dysenteriae
 - E. None of the Above
203. _____ is implicated as one of the pathogenic causes of reactive arthritis worldwide.
- A. Giardia lamblia
 - B. Cryptosporidiosis
 - C. Entamoeba histolytica
 - D. Shigella
 - E. None of the Above
204. _____ hepatitis is not easily spread through sex. You're more likely to get it through contact with infected blood, contaminated razors, needles, tattoo and body-piercing equipment, or manicure or pedicure tools that haven't been properly sanitized, and a mother can pass it to her baby during delivery.
- A. Type A
 - B. Type B
 - C. Type C
 - D. Type D
 - E. None of the Above
205. _____ hepatitis can be passed through contact with infected blood, contaminated needles, or by sexual contact with an HIV-infected person.
- A. Type A
 - B. Type B
 - C. Type C
 - D. Type D

E. None of the Above

206. _____ hepatitis is most likely to be transmitted in feces, through oral contact, or in water that's been contaminated.

- A. Type A
- B. Type B
- C. Type C
- D. Type E
- E. None of the Above

207. _____ hepatitis is contracted through anal-oral contact, by coming in contact with the feces of someone with hepatitis A, or by eating or drinking hepatitis A contaminated food or water.

- A. Type A
- B. Type B
- C. Type C
- D. Type D
- E. None of the Above

208. _____ hepatitis can be contracted from infected blood, seminal fluid, vaginal secretions, or contaminated drug needles, including tattoo or body-piercing equipment. It can also be spread from a mother to her newborn.

- A. Type A
- B. Type B
- C. Type C
- D. Type D
- E. None of the Above

Water Use or Demand

209. Water system _____ comes from a number of sources including residential, commercial, industrial and public consumers as well as some unavoidable loss and waste.

- A. Per person
- B. Average daily use
- C. Quantity and pressure
- D. Demand
- E. None of the Above

210. If fire protection is desired, that could also represent a rather significant (although not continuous) _____.

- A. Per person
- B. Average daily use
- C. Quantity and pressure
- D. Demand upon the system
- E. None of the Above

211. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for quality, _____ at all times.

- A. Per person
- B. Average daily use
- C. Quantity and pressure
- D. Demand upon the system
- E. None of the Above

212. The _____ of water used in any community varies from 50 to 500 gallons per person per day.

- A. Per person
- B. Average daily use
- C. Quantity
- D. Demand upon the system
- E. None of the Above

213. A common design assumption is to use from 100 to 150 gallons _____ per day for average domestic use.

- A. Per person
- B. Average daily use
- C. Quantity and pressure
- D. Demand upon the system
- E. None of the Above

214. The _____ is approximately 2 to 3 times the average daily use.

- A. Water pressure
- B. Minimum required
- C. Maximum daily use
- D. Demand
- E. None of the Above

215. _____ is usually encountered during the summer months and can vary widely depending on irrigation practices.

- A. Water pressure
- B. Minimum required
- C. Maximum daily use
- D. Demand
- E. None of the Above

Water Pressure

216. For ordinary domestic use, _____ should be between 25 and 45 psi.

- A. Water pressure
- B. Minimum required
- C. Maximum daily use
- D. Demand
- E. None of the Above

217. A minimum of 60 psi at a fire hydrant is usually adequate, since that allows for up to 20 psi _____ in fire hoses.

- A. Water pressure
- B. Minimum required
- C. Maximum daily use
- D. Pressure drop
- E. None of the Above

218. In commercial and industrial districts, it may be common to have 75 psi or higher. 20 psi is considered the _____ at any point in the water system, so that backflow and infiltration is prevented.

- A. Water pressure
- B. Minimum required
- C. Maximum daily use
- D. Demand
- E. None of the Above

219. Pressure is provided by the _____ of the water (such as water from a pump), or by the height of the water (such as a storage reservoir). 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. Water pressure
- B. Minimum required
- C. Maximum daily use
- D. Direct force
- E. None of the Above

Water Use or Demand

220. Water system demand comes from a _____ including residential, commercial, industrial and public consumers as well as some unavoidable loss and waste.

- A. Quality, quantity and pressure
- B. Unavoidable loss and waste
- C. Common design assumption
- D. Number of sources
- E. None of the Above

221. If fire protection is desired, that could also represent a rather significant (although not continuous) _____.

- A. Quality, quantity and pressure
- B. Unavoidable loss and waste
- C. Common design assumption
- D. Rather significant
- E. None of the Above

222. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for _____ at all times.

- A. Quality, quantity and pressure
- B. Unavoidable loss and waste
- C. Common design assumption
- D. Rather significant
- E. None of the Above

223. The quantity of water used in any community varies from 50 to 500 gallons per person per day. A _____ is to use from 100 to 150 gallons per person per day for average domestic use.

- A. Quality, quantity and pressure
- B. Unavoidable loss and waste
- C. Common design assumption
- D. Pressure
- E. None of the Above

224. The _____ is approximately 2 to 3 times the average daily use. Maximum daily use is usually encountered during the summer months and can vary widely depending on irrigation practices.

- A. Quality, quantity and pressure
- B. Unavoidable loss and waste
- C. Maximum daily use
- D. Pressure
- E. None of the Above

Water Pressure

225. For ordinary _____, water pressure should be between 25 and 45 psi.

- A. Domestic use
- B. Commercial and industrial districts
- C. Supplying water
- D. On-going maintenance costs
- E. None of the Above

226. A minimum of 60 psi at a fire hydrant is _____, since that allows for up to 20 psi pressure drop in fire hoses.

- A. Minimum required
- B. Commercial and industrial districts
- C. Supplying water
- D. Usually adequate
- E. None of the Above

227. In _____, it may be common to have 75 psi or higher.

- A. Minimum required
- B. Commercial and industrial districts
- C. Supplying water
- D. On-going maintenance costs
- E. None of the Above

228. 20 psi is considered the minimum required at any point in the water system, so that backflow and _____.

- A. Infiltration is prevented
- B. Commercial and industrial districts
- C. Supplying water
- D. On-going maintenance costs
- E. None of the Above

229. Pressure is provided by the _____ of the water (such as water from a pump), or by the height of the water (such as a storage reservoir). 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. Minimum required
- B. Commercial and industrial districts
- C. Supplying water
- D. Direct force
- E. None of the Above

Storage and Distribution

230. The _____ water to the users of any water system includes the installation of storage and distribution facilities.

- A. Minimum required
- B. Commercial and industrial districts
- C. Cost of supplying
- D. On-going maintenance costs
- E. None of the Above

231. There are _____ associated with cleaning, repairing and replacing these facilities.
- A. Minimum required
 - B. Commercial and industrial districts
 - C. Supplying water
 - D. On-going maintenance costs
 - E. None of the Above
232. The distribution system must also _____ between the source and the customer's tap.
- A. Protect water quality
 - B. Be aware of this phenomenon
 - C. Measure the pressure potential energy
 - D. Maintain system integrity
 - E. None of the Above
233. Proper construction is important in maintaining system integrity. Care must be taken that no foreign material is _____ during pipe laying operations.
- A. Flushed
 - B. Aware of this phenomenon
 - C. Introduced into the system
 - D. Maintaining system integrity
 - E. None of the Above
234. Pipe ends should be covered at the end of the work day or during _____.
- A. Interruptions of construction
 - B. This phenomenon
 - C. Pressure changes
 - D. System integrity
 - E. None of the Above
235. All _____ should be pressure tested and disinfected with a 5% chlorine solution such as household bleach before backfilling.
- A. Water distribution systems
 - B. Aware of this phenomenon
 - C. Pressure potential energy
 - D. Maintaining system integrity
 - E. None of the Above

Water Storage Facilities

236. Water storage facilities and tanks vary in _____. There are different types that are used in the water distribution systems, such as stand pipes, elevated tanks and reservoirs, hydropneumatic tanks and surge tanks.
- A. Water distribution systems
 - B. Size, shape, and application
 - C. Pressure potential energy
 - D. Pascals
 - E. None of the Above

Surge Tanks

237. What really causes _____ - ENERGY - when released in a confined space, such as a water distribution system.

- A. Water distribution systems to lose pressure
- B. Hammer phenomenon
- C. Pressure potential energy
- D. Water main breaks
- E. None of the Above

238. Shock waves are created when hydrants, valves, or pumps are opened and closed quickly, _____ of moving water within the confined space of a piping system.

- A. Valving
- B. Trapping the kinetic energy
- C. Pressure potential energy
- D. Maintaining system integrity
- E. None of the Above

239. _____ can create a turbulence that travels at the speed of sound, seeking a point of release.

- A. Water service connections
- B. These shock waves
- C. Pressure potential energy
- D. Valves
- E. None of the Above

240. The _____ usually finds is an elevated tank, but the surge doesn't always find this release quickly enough. Something has to give, and oftentimes, it's your pipe fittings. Distribution operators are aware of this phenomenon! It's called WATER HAMMER.

- A. Air
- B. Release the surge
- C. Pressure of potential energy
- D. Pressure
- E. None of the Above

241. A Surge tank should not be used for _____.

- A. Storing energy
- B. Storing water up high
- C. Water storage
- D. Storage be equalized
- E. None of the Above

242. The goal of the water tower or stand pipe is to _____ in the air, where it has lots of gravitational potential energy.

- A. Stored energy
- B. Store water high
- C. Water storage
- D. Storage be equal
- E. None of the Above

243. This _____ can be converted to pressure potential energy or kinetic energy for delivery to homes.

- A. Stored energy
- B. Store water high
- C. Water storage
- D. None of the Above

244. Since height is everything, building a cylindrical water tower is inefficient. Most of the water is then near the ground. By making the tower wider near the top, it puts most of its _____.
- A. Energy up high
 - B. Water up high
 - C. Water storage
 - D. Storage be equal
 - E. None of the Above

Storage Reservoirs

245. Storage reservoirs allow the system to meet the fluctuations in demand described earlier. It is recommended that the volume of storage be equal to from one to three days of the system's _____.

- A. Stored energy
- B. Store water high
- C. Average daily use
- D. Storage be equal
- E. None of the Above

246. It is also recommended that storage reservoirs be located at a high enough elevation to allow the water to _____ to the distribution system.

- A. Water Hammer
- B. Pump in
- C. Flow by gravity
- D. Store
- E. None of the Above

247. This, coupled with restricted usage on the part of the consumers, should provide an uninterrupted water supply in the event of pump failure, loss of power or an acute contamination event or _____. Also, if applicable, some storage for fire protection should be provided.

- A. Pump failure
- B. Cross-connection
- C. Attack
- D. Construction
- E. None of the Above

248. Reservoirs are also used as detention basins to provide the required chlorine contact time necessary to ensure the _____.

- A. Pump will not fail
- B. Adequacy of disinfection
- C. Flow of water
- D. Lower construction costs
- E. None of the Above

249. As such, the contact time in a reservoir is _____ when the reservoir is constructed with a separate inlet and outlet pipe, preferably located on opposite sides of the reservoir and at different levels.

- A. Greatly improved
- B. On opposite sides
- C. Apparently degraded
- D. Turned off
- E. None of the Above

250. Baffles inside the reservoir (walls, curtains, or spirals) increase the contact time by preventing the water from leaving the reservoir too quickly (known as “_____”).
- A. Shocked
 - B. Chlorinated
 - C. Degraded
 - D. Short-circuiting
 - E. None of the Above

Steel Reservoirs

251. Steel reservoirs or tanks generally have lower construction and installation costs than concrete, but _____.

- A. Require more maintenance
- B. Will create more positive samples
- C. Illegal in some states
- D. Have lower construction costs
- E. None of the Above

252. To protect against corrosion, the exterior should be kept cleaned and painted. Interiors of steel reservoirs are _____ with an epoxy or enamel-type finish.

- A. Insured
- B. Commonly coated
- C. Coated with lime
- D. Coated with iron
- E. None of the Above

253. Some coal-tar linings used in the past have apparently degraded over time and are implicated in the release of _____ into the stored water.

- A. Iron particles
- B. Small amounts of solvents
- C. Bird droppings
- D. Chlorine
- E. None of the Above

254. Steel reservoirs are usually welded or bolted together and are manufactured in a variety of sizes. Small steel reservoirs can be _____ and then trucked and lifted into place.

- A. Heavy
- B. Shipped
- C. Welded
- D. Manufactured off-site
- E. None of the Above

255. Steel tanks should be inspected once a year and _____ every 5-7 years.

- A. Repainted
- B. Replaced
- C. Degraded
- D. Construction
- E. None of the Above

256. Steel tank should also have cathodic protection and be screened to keep birds and insects out. The maintenance program for reservoir tanks should call for _____ for a complete inspection of the interior.

- A. Pump failure
- B. Annual draining
- C. Sampling plan
- D. Scuba diver
- E. None of the Above

257. Cleaning and disinfection _____ the reservoir or tank back in service is necessary.

- A. Chemicals and procedures are important for
- B. Is not that important
- C. Prior to placing
- D. Should be outsourced
- E. None of the Above

Disinfection by chlorine can be accomplished by one of three methods:

258. Fill the tank or reservoir with a 25 mg/1 _____ and leave it for 24 hours.

- A. Chlorine solution
- B. Chlorinated water
- C. OCL solution
- D. Corrosion fluid
- E. None of the Above

259. Fill the reservoir with a 50 mg/1 _____ and leave it for 3 hours.

- A. Chlorine solution
- B. Chlorinated water
- C. HCL
- D. HOCL
- E. None of the Above

260. Spray or brush on a 200 mg/1 _____ and allow it to remain for 3 hours.

- A. Chlorine solution
- B. Chlorinated water
- C. HCL
- D. HOCL
- E. None of the Above

261. The _____ shall be disposed of in a manner that will not have an adverse effect on the environment. Check with your state environmental, health or drinking water section.

- A. Chlorine solution
- B. Chlorinated water
- C. HCL
- D. HOCL
- E. None of the Above

262. The distribution system is the piping that delivers water to service connections. There are several types of piping material that can be used. Each has its _____.

- A. Methods to reduce the time
- B. Service plans for maintenance
- C. Advantages and disadvantages
- D. Corrosion resistant exteriors
- E. None of the Above

263. The pipe material must have adequate strength to withstand external loads from backfill, traffic and earth movement, high burst strength to withstand high water pressure, smooth interior surfaces, _____ and tight joints.

- A. Compaction techniques
- B. Service for maintenance procedures
- C. Advantages and disadvantages
- D. Corrosion resistant exteriors
- E. None of the Above

Hydropneumatic Tank Section

Effects on the Water Supply

264. Whenever a tank must _____, the operator should insure that the water pressure is maintained by other back-up tanks in the system.

- A. Be changed
- B. Be taken out of service for maintenance
- C. Be filled
- D. Be drained
- E. None of the Above

265. If this is not possible, _____ should be given as much advance notice as possible, maintenance should be conducted during periods of low water demand, and the maintenance should be conducted as quickly as possible to reduce the time without water service.

- A. Operator(s)
- B. Hydropneumatic tank operations (operators)
- C. Individuals
- D. Customers
- E. None of the Above

Troubleshooting Hydropneumatic Tank Problems

266. The purpose of a _____ is to provide air for the water system. It is the responsibility of the operator to perform basic troubleshooting of problems in hydropneumatic tank systems.

- A. Operator(s)
- B. Hydropneumatic tank
- C. Individuals
- D. Interrupting the supply to other locations
- E. None of the Above

267. The _____ has to decide, based on his/her own training and capability when a problem requires assistance from another operator or an outside expert.

- A. Operator(s)
- B. Hydropneumatic tank
- C. Individuals
- D. Interrupting the supply to other locations
- E. None of the Above

268. _____ should not hesitate to seek assistance if they are uncomfortable with a particular problem or situation.

- A. Operator(s)
- B. Hydropneumatic tank personnel
- C. Individuals
- D. Crew Leaders
- E. None of the Above

269. The goal is to provide a safe and consistent supply of water and this cannot always be accomplished by one or two _____ who may have many other responsibilities. Corrective action should only be performed by individuals who are trained and skilled in that particular area.

- A. Operator(s)
- B. Hydropneumatic tanks
- C. Individuals
- D. Crew Leaders
- E. None of the Above

Distribution Valves

270. The purpose of installing _____ in water mains at various locations within the distribution system is to allow sections of the system to be taken out of service for repairs or maintenance, without significantly curtailing service over large areas.

- A. Shutoff valves
- B. Connections
- C. Valve boxes
- D. Vaults or manholes
- E. None of the Above

271. _____ should be installed at intervals not greater than 5,000 feet in long supply lines, and 1,500 feet in main distribution loops or feeders.

- A. Fire hydrants
- B. PRVs
- C. Valves
- D. Vaults or manholes
- E. None of the Above

272. All branch mains connecting to feeder mains or feeder loops should have valves installed as close to the feeders as practical. In this way, _____ can be taken out of service without interrupting the supply to other locations.

- A. Fire Hydrants
- B. Service Connections
- C. Valves
- D. Branch mains
- E. None of the Above

273. In the areas of greatest water demand, or when the dependability of the distribution system is particularly important, _____ of 500 feet may be appropriate.

- A. Installing shutoff valves
- B. Service connections
- C. Valve spacing
- D. Vaults or manholes
- E. None of the Above

274. At intersections of distribution mains, the number of _____ required is normally one less than the number of radiating mains.

- A. Fire Hydrants
- B. Handwheels
- C. Valves
- D. Sample taps
- E. None of the Above

275. The _____ omitted from the line is usually the one that principally supplies flow to the intersection.

- A. POE
- B. Stoneline
- C. Valve
- D. Vault or manhole
- E. None of the Above

276. _____ should be installed in standardized locations (that is, the northeast corner of intersections or a certain distance from the center line of streets), so they can be easily found in emergencies.

- A. Meter boxes
- B. Service risers
- C. Shutoff valve(s)
- D. Vaults or manholes
- E. None of the Above

277. All buried small and medium-sized valves should be installed in valve boxes. For large shutoff valves (about 30 inches in diameter and larger), it may be necessary to surround the valve operator or entire _____ within a vault or manhole to allow repair or replacement.

- A. Meter boxes
- B. Service risers
- C. Valve(s)
- D. Vaults or manholes
- E. None of the Above

Classification of Valves

278. There are two major classifications of water _____: Rotary and Linear. Linear is a fancy word for up and down or blade movement.

- A. Meter boxes
- B. Service risers
- C. Valve(s)
- D. Vaults or manholes
- E. None of the Above

Gate Valve Linear Valve Our primary Linear valve

279. The most common valve in the distribution system. Primarily used for _____. Should be exercised on annual basis.

- A. Installing shutoff valves
- B. Interrupting the supply
- C. Main line shut downs
- D. Vaults or manholes
- E. None of the Above

280. _____ are used when a straight-line flow of fluid and minimum flow restriction are needed.

- A. Wedge-shaped
- B. Pressure drop
- C. Gate valve
- D. Handwheel
- E. None of the Above

281. _____ are so-named because the part that either stops or allows flow through the valve acts somewhat like a gate.

- A. Wedge-shaped
- B. Pressure drop
- C. Gate valve
- D. Rotary
- E. None of the Above

282. The gate is usually _____. When the valve is wide open the gate is fully drawn up into the valve bonnet.

- A. Wedge-shaped
- B. Pressured drop
- C. Gate valve
- D. Vault or manhole
- E. None of the Above

283. This leaves an opening for flow through the valve the _____ as the pipe in which the valve is installed.

- A. Same size
- B. Pressures drop
- C. Bonnet
- D. Port
- E. None of the Above

284. Therefore, there is little _____ or flow restriction through the valve. Gate valves are not suitable for throttling purposes.

- A. Change
- B. Pressure drop
- C. Fiction
- D. Need
- E. None of the Above

285. The _____ is difficult because of the valve's design, and the flow of fluid slapping against a partially open gate can cause extensive damage to the valve.

- A. Shutting the water off
- B. Upflow
- C. Creation of a water hammer
- D. Control of flow
- E. None of the Above

286. Except as specifically authorized, gate valves _____.

- A. Are to shut the water off and throttle
- B. Should not be used for throttling
- C. Are for creating a water hammer
- D. Are jammed-tight
- E. None of the Above

287. Dr. Rusty Randall(Lead Instructor) likes to listen to the Valve Key when shutting down a Gate valve. You will easily hear it sing as you _____ or leak by.

- A. Shut the water off
- B. Turn the key on
- C. Create a water hammer
- D. Jam the bonnet
- E. None of the Above

288. It is very easy to _____ with opening or closing a Gate valve. Always take your time when operating a gate valve or any valve.

- A. Bounce the main
- B. Shut off the water quickly
- C. Create a water hammer
- D. Jam the port
- E. None of the Above

Problems

Valve Jammed Open

289. Dr. Rusty recommends that opened valves should not be _____ on the backseat.

- A. Shut the water off
- B. Specifically authorized
- C. Create a water hammer
- D. Jammed-tight
- E. None of the Above

290. Always back the valve-off a _____ from the fully opened position.

- A. Back seat
- B. Torque applicator
- C. Quarter-section
- D. Quarter turn
- E. None of the Above

291. Note that motor operated valves coast inevitably to the backseat by tripping on a limit switch. Valve should not be _____ on torque.

- A. Back seated
- B. Torque applied
- C. Worked
- D. Valve sealed
- E. None of the Above

Valve Jammed Closed

292. Variations in the temperature and/or pressure of the working fluid are often the cause of a valve _____.

- A. Back seating
- B. Torquing
- C. Failing to open
- D. Valve sealing
- E. None of the Above

293. _____ can occur in high temperature situations depending on the seat and wedge material, length of exposure and closing torque applied.

- A. Back seating
- B. Torque applying
- C. Thermal binding
- D. Valve sealing
- E. None of the Above

294. Thermal binding can cause galling on the _____ surfaces as well as on the guides.

- A. Back seat
- B. Torque applying
- C. Working fluid
- D. Valve sealing
- E. None of the Above

295. A valve can lock in the closed position when high pressure enters the cavity and has no way to escape. This is known as _____.

- A. Back seated
- B. Torque applied
- C. Over-pressurization
- D. Valve sealing
- E. None of the Above

If Excessive Torque is Needed to Work the Valve

296. Variations in the temperature and/or pressure of the working fluid are often the cause of a valve _____.

- A. Back seated
- B. Failing to open
- C. Working
- D. Valve sealing
- E. None of the Above

297. _____ can occur in high temperature situations depending on the seat and wedge material, length of exposure and closing torque applied.

- A. Back seating
- B. Torque applying
- C. Thermal binding
- D. Valve sealing
- E. None of the Above

298. _____ can cause galling on the valve sealing surfaces as well as on the guides.

- A. Back seating
- B. Warping
- C. Thermal binding
- D. Valve sealing
- E. None of the Above

299. A valve can lock in the closed position when high pressure enters the cavity and has no way to escape. This is known as _____.

- A. Back seating
- B. Torque bending
- C. Thermal binding
- D. Over-pressurization
- E. None of the Above

300. Single direction sealing gate valves have a nameplate on the side of the valve that has a relief hole or _____. This should be the high pressure side when the valve is closed.

- A. PRV
- B. Torque port
- C. Relief
- D. Pressure equalizer
- E. None of the Above

Globe Valve Rotary Valve

301. It is primarily used for _____, and works similar to a faucet. Rare to find in most distribution systems, but can be found at treatment plants.

- A. Flow regulation
- B. Safety procedures
- C. Renewing seat ring
- D. Economical flow control
- E. None of the Above

302. Always follow _____ when working on a valve.

- A. Flow regulation
- B. Standard safety procedures
- C. Valve man instructions
- D. Flow control
- E. None of the Above

303. Most Globes have compact OS & Y type, bolted bonnet, rising stem, with _____ valves.

- A. Flow regulation arrows
- B. Standard safety procedures
- C. Renewable seat ring
- D. Economical flow control
- E. None of the Above

304. A Check Valve spring loaded disc resulting with most advanced design features provides the ultimate in dependable, _____.

- A. Flow regulation
- B. Standard sizes
- C. Renewable seat ring
- D. Economical flow control
- E. None of the Above

305. Globe valves should usually be installed with the inlet below the valve _____.

- A. Stem
- B. Valves
- C. Packings
- D. Seat
- E. None of the Above

306. For severe _____, the valve may be installed so that the flow enters over the top of the seat and goes down through it. Note that in this arrangement, the packings will be constantly pressurized.

- A. Stem use
- B. Throttling service
- C. Packing
- D. Upright service
- E. None of the Above

307. If the valve is to be installed near throttling service, verify with an outside contractor or a skilled valve technician. Globe valves, per se, are not suitable for _____.

- A. Non-rising stem
- B. Underground use
- C. Raw water
- D. Throttling service
- E. None of the Above

308. The valve should be welded onto the line with the disc in the fully closed position. Leaving it even partially open can cause distortion and leaking. Allow time for the weld to cool before operating the _____ the first time in the pipeline. The preferred orientation of a globe valve is upright.

- A. Stem
- B. Valve
- C. Packings
- D. Bonnet
- E. None of the Above

309. The valve may be installed in other orientations, but any deviation from vertical is a compromise. Installation upside down is not recommended because it can cause dirt to accumulate in the _____.

- A. Stem
- B. Valves
- C. Packings
- D. Bonnet
- E. None of the Above

Globe Valve Problems and Solutions

310. If the valve _____ is improperly lubricated or damaged: disassemble the valve and inspect the stem.

- A. Stem
- B. Valves
- C. Packing
- D. Port relief
- E. None of the Above

311. Acceptable deviation from theoretical centerline created by joining center points of the ends of the stem is 0.005"/ft of _____. Inspect the threads for any visible signs of damage.

- A. Stem
- B. Valves
- C. Packing
- D. Bonnet
- E. None of the Above

312. Small _____ less than 0.005" can be polished with an Emory cloth.

- A. Stems
- B. Valves
- C. Packings
- D. Bonnets
- E. None of the Above

313. Contact specialized services or an outside contractor if run-out is unacceptable or large grooves are discovered on the surface of the _____.
- A. Stem
 - B. Valves
 - C. Packing
 - D. Bonnet
 - E. None of the Above
314. If the valve _____ compression is too tight: Verify the packing bolt torque and adjust if necessary.
- A. Stem
 - B. Valves
 - C. Packing
 - D. Bonnet
 - E. None of the Above
315. Foreign debris is trapped on threads and/or in the packing area: This is a common problem when _____ are installed outdoors in sandy areas and areas not cleaned before operating.
- A. Stem
 - B. Valves
 - C. Packings
 - D. Bonnets
 - E. None of the Above
316. Always inspect threads and _____ area for particle obstructions, even seemingly small amounts of sand trapped on the drive can completely stop large valves from cycling.
- A. Stem
 - B. Valves
 - C. Packing
 - D. Bonnets
 - E. None of the Above
317. The valve may stop abruptly when a cycle is attempted. With the line pressure removed from the valve, disconnect the actuator, gear operator, or handwheel and inspect the drive nut, _____, bearings and yoke bushing.
- A. Stem
 - B. Valves
 - C. Packings
 - D. Bonnets
 - E. None of the Above
318. _____ should be cleaned with a lint-free cloth using alcohol, varsol or equivalent. All parts should be re-lubricated before re-assemble.
- A. Backflow assemblies
 - B. Contaminated parts
 - C. Valve components
 - D. Handwheel
 - E. None of the Above

319. If the valves are installed outdoors in a sandy area, it may be desirable to cover the _____ with jackets.

- A. Backflow assemblies
- B. Swing check
- C. Valves
- D. Handwheel
- E. None of the Above

320. There are basically two types of PRV controllers: time based (to reduce the pipe pressure at low demand times, e.g. at night) or flow modulated which can realize leakage savings throughout the _____ (by adjusting the pressure according to the demand, to prevent excessive pressure at any time of the day or night).

- A. Allow water from the distribution system
- B. Controller and a separate data logger
- C. Day and night
- D. Spring and the weight
- E. None of the Above

Valve Exercising

321. Valve exercising should be done once per year (especially main line valves) to detect _____ from becoming inoperable due to freezing or build-up of rust or corrosion.

- A. Hammer sources
- B. Faulty controllers
- C. Malfunctioning valves and to prevent valves
- D. Spring and the weight
- E. None of the Above

322. A valve inspection should include _____ to show distances (ties) to the valves from specific reference points (telephone poles, stonelines, etc.).

- A. Malfunctioning valves and to prevent valves
- B. Spring and the weight
- C. Allow water from the distribution system
- D. Controller and a separate data logger
- E. None of the Above

323. Hydrants are designed to _____ to be used for fire-fighting purposes.

- A. Allow water from the distribution system
- B. Control data loggers
- C. Prevent malfunctioning valves
- D. Capture spring
- E. None of the Above

324. If a(n) _____ is found to be inoperable, a tag is placed on the hydrant, and the "out of service" is immediately reported to the Fire Department.

- A. Fire hydrant(s)
- B. Emergency
- C. Water department yard
- D. Nozzle cap thread gaskets
- E. None of the Above

325. Accurate records related to the maintenance procedures performed on the fire hydrants are maintained by the _____.

- A. Fire hydrant(s)
- B. Police Department
- C. Water department
- D. Valve man
- E. None of the Above

Water Meters

326. It is important to account for the water produced and supplied. A _____ should be installed on each source, with service meters placed at each point of use. These should be read and recorded periodically.

- A. Water utility
- B. Service meter
- C. Master meter
- D. Head loss calculation
- E. None of the Above

327. Totals from the _____ should be compared to totals from the service meters to compute the amount of water lost in the distribution system. This information is important in locating and eliminating leaks and unauthorized taps.

- A. Water utilities
- B. Service meters
- C. Master meters
- D. Head loss calculation
- E. None of the Above

328. _____ tend to water freely and have little incentive to repair plumbing leaks.

- A. Water utilities
- B. Service meters
- C. Master meters
- D. Un-metered water users
- E. None of the Above

Tree System

329. Older water systems frequently were expanded without planning and developed into a _____ system. This consists of a single main that decreases in size as it leaves the source and progresses through the area originally served.

- A. Treelike
- B. Fire fighting
- C. Regular interval
- D. Friction loss type of a
- E. None of the Above

330. Smaller pipelines branch off the main and divide again, much like the trunk and branches of a _____.

- A. Tree
- B. Firefighting system
- C. Regular interval
- D. Friction loss branch
- E. None of the Above

331. A _____ system is not desirable because the size of the old main limits the expansion of the system needed to meet increasing demands.

- A. Treelike
- B. Fire fighting
- C. Regular distribution
- D. Riser
- E. None of the Above

332. There are many _____ in the system where water remains for long periods, causing undesirable tastes and odors in nearby service lines.

- A. Treelike branches
- B. Globe valves
- C. Regular service connections
- D. Dead ends
- E. None of the Above

333. The most reliable means to provide water for _____ is by designing redundancy into the system.

- A. Treelike providing
- B. Fire fighting
- C. Regular pumping
- D. Friction loss
- E. None of the Above

334. There are several advantages gained by laying out water mains in a loop or grid, with feeder and distributor mains interconnecting at roadway intersections and other _____.

- A. Treelike fixtures
- B. Fire Hydrants
- C. Regular intervals
- D. Crop installations
- D. None of the Above

Friction Loss

335. Water will still be distributed through the system if a single section fails. The damaged section can be isolated and the remainder of the system will still _____.

- A. Work
- B. Carry water
- C. Shut down
- D. Create friction loss
- E. None of the Above

336. Water supplied to fire hydrants will feed from multiple directions. Thus 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 will be less since several mains will be sharing the supply.

- A. Cross-connections
- B. Water hammers
- C. Pressure bashes
- D. Friction loss
- E. None of the Above

Types of Pipes Used in the Distribution Field

Several types of pipe are used in water distribution systems, but only the most common types used by operators will be discussed. These piping materials include copper, plastic, galvanized steel, and cast iron.

Plastic Pipe (PVC)

337. This is currently the most common type of pipe used in _____. It is available in diameters of 1/2" and larger, and in lengths of 10', 20', and 40'.

- A. Easy installations
- B. Resistance determinations
- C. C Factor sizing
- D. Temperatures variations
- E. None of the Above

338. A main advantage is its light weight, allowing for _____. A disadvantage is its inability to withstand shock loads.

- A. Easy installation
- B. Resistance determinations
- C. C Factor sizing
- D. Temperatures variations
- E. None of the Above

339. Since it is _____, a tracer wire must be installed with the PVC water main so that it can be located after burial.

- A. Easily installed
- B. Light weight
- C. Non-metallic
- D. Temperature proof
- E. None of the Above

340. The National Sanitation Foundation (NSF) currently lists most brands of PVC pipe as being acceptable for potable water use. This information should be stamped on the outside of the pipe, along with working pressure and temperature, diameter and pipe manufacturer. PVC pipe will have the highest _____ of all the above pipes.

- A. Strength rating
- B. Resistance rating
- C. C Factor
- D. Temperature rating
- E. None of the Above

341. The higher the _____ the smoother the pipe.

- A. Strength rating
- B. Resistance rating
- C. C Factor
- D. Temperature rating
- E. None of the Above

342. Plastic pipe has seen _____ in current construction. Available in different lengths and sizes, it is lighter than steel or copper and requires no special tools to install.

- A. Easy installation
- B. Resistance
- C. Extensive use
- D. Temperatures
- E. None of the Above

343. Plastic pipe has several advantages over metal pipe. It is flexible, it has superior resistance to rupture from freezing, it has complete _____ to corrosion and in addition, it can be installed above ground or below ground.

- A. Priority
- B. Resistance
- C. Utilization
- D. Restriction
- E. None of the Above

344. One of the most _____ plastic and polyvinyl resin pipes is the polyvinyl chloride (PVC). PVC pipes are made of tough, strong thermoplastic material that has an excellent combination of physical and chemical properties.

- A. Easy installation
- B. Resistance
- C. Versatile
- D. Temperatures
- E. None of the Above

345. A CPVC pipe (a chlorinated blend of PVC) can be used not only in cold-water systems, but also in hot-water systems with _____ up to 210°F.

- A. Easy installation
- B. Resistance
- C. C Factor
- D. Temperatures
- E. None of the Above

346. _____ of installation make plastic pipe popular for use in either water distribution and supply systems or sewer drainage systems.

- A. Economy and ease
- B. Resistance
- C. C Factor
- D. Temperatures
- E. None of the Above

Cast Iron (CIP)

347. This is another type of _____ that has been in use for a long time. It is found in diameters from 3" to 48".

- A. Advantage(s)
- B. Disadvantage(s)
- C. Installation
- D. Corrosion problems
- E. None of the Above

348. Advantages of this material are its long life, _____ and ability to withstand working pressures up to 350 psi.

- A. Advantage(s)
- B. Disadvantage(s)
- C. Installation
- D. Corrosion problems
- E. None of the Above

349. _____ include the fact that it is heavy, difficult to install and does not withstand shock loading. Although it is not currently the material of choice, there is still a lot of it in the ground.

- A. Advantage(s)
- B. Disadvantage(s)
- C. Installation
- D. Corrosion problems
- E. None of the Above

Ductile Iron Pipe (DIP)

350. This was developed to overcome the _____ associated with cast iron pipe. It can be purchased in 4" to 45" diameters and lengths of 18' to 20'.

- A. Advantage(s)
- B. Disadvantage(s)
- C. Installation
- D. Corrosion problems
- E. None of the Above

351. Its main _____ is that it is nearly indestructible by internal or external pressures. It is manufactured by injecting magnesium into molten cast iron.

- A. Advantage(s)
- B. Disadvantage(s)
- C. Installation
- D. Corrosion problems
- E. None of the Above

352. It is sometimes protected from highly corrosive soils by wrapping the pipe in plastic sheeting prior to _____. This practice can greatly extend the life of this type of pipe.

- A. Advantage(s)
- B. Disadvantage(s)
- C. Installation
- D. Corrosion problems
- E. None of the Above

Water Main Installation

353. _____ of new or replacement pipe sections should be in accordance with good construction practices.

- A. Thrust blocking
- B. Ground surface area
- C. Installation
- D. Good construction practices
- E. None of the Above

354. The line must be _____ a minimum of 30" below the ground surface to prevent freezing.

- A. Buried
- B. Under surfaces
- C. Bedded and backfilled
- D. Constructed even
- E. None of the Above

355. The line must be _____ properly insuring protection from weather and surface loadings.
- A. Thrust blocked
 - B. Ground surface
 - C. Bedded and backfilled
 - D. In good construction practices
 - E. None of the Above
356. Thrust blocking (Kickers) at all bends, tees, and valves is essential to hold the pipe in place and prevent _____.
- A. Separation of line sections
 - B. Ground surface egress
 - C. Bedded and backfilled
 - D. Gopher attacks
 - E. None of the Above
357. _____ is not necessary if the pipe is welded.
- A. Thrust blocking
 - B. Ground surface tapping
 - C. Bedding and backfilled
 - D. Good construction practice
 - E. None of the Above
358. _____ of new installations or repaired sections is required prior to placing them in service. This can be accomplished by filling the line with a 25 mg/1 free chlorine solution and allowing it to stand for 24 hours.
- A. Thrust blocking
 - B. Ground surface
 - C. Bedding and backfilling
 - D. Good construction practices
 - E. None of the Above
359. Valves and fittings used in the _____ are made of cast iron, steel, brass, stainless and fiberglass.
- A. Minimal service disruption
 - B. Remove accumulated sediment
 - C. Installed at high points
 - D. On dead end lines
 - E. None of the Above
360. Enough gate valves should be placed throughout the system to enable problem areas (leaks, etc.) to be _____ with minimal service disruption.
- A. Minimal service disruptions
 - B. Remove accumulated sediment
 - C. Installed at high points
 - D. Isolated and repaired
 - E. None of the Above
361. Air relief valves should be _____ in the system.
- A. Minimal service disruption
 - B. Remove accumulated sediment
 - C. Installed at high points
 - D. On dead end lines
 - E. None of the Above

362. Valves should be installed with _____.
- Minimal service disruption
 - Remove accumulated sediment
 - Installed at high points
 - On dead end lines
 - None of the Above
363. Regardless of the type of pipe installed, certain maintenance routines should be performed on the distribution system to _____. These programs should be scheduled and performed on a regular basis.
- Minimal service disruption
 - Remove accumulated sediment
 - Installed at high points
 - Maintain water quality and optimal service
 - None of the Above
364. _____ on dead end lines and at fire hydrants throughout the system should be done at least twice per year.
- Minimal service disruption
 - Remove accumulated sediment
 - Installed at high points
 - On dead end lines
 - None of the Above
365. Flushing is needed to _____ in dead ends and to remove accumulated sediment that results from turbidity, iron, manganese, etc.
- Minimal service disruption
 - Remove stagnant water
 - Installed at high points
 - On dead end lines
 - None of the Above
366. This should also help _____. Flushing should always be done from the source to the ends of the system.
- Pressure tests
 - Constant evaluation of the system
 - Minimize customer complaints of water quality
 - Determine if pipe capacity
 - None of the Above
367. Affected customers should be notified of this process in advance. To do an adequate job of flushing, the flow should reach a velocity of at least 2.5 feet per second, known as the "_____" of the system (at hydrant locations).
- Pressure tests
 - Evaluation
 - Minimum cleansing velocity
 - Pipe capacity
 - None of the Above
368. These tests are important to determine the adequacy of the distribution system in _____ particularly during days of peak demand.
- Pressure tests
 - Evaluating the system
 - Compaction tests
 - Pipe capacity
 - None of the Above

369. These tests can help determine if pipe capacity is decreasing over time due to _____ or deposits.

- A. Pressure tests
- B. Constant evaluation
- C. Minimum cleansing velocity
- D. Internal corrosion
- E. None of the Above

370. _____ should be done at various locations in the distribution system several times per year.

- A. Pressure tests
- B. Constant evaluation of the system
- C. Minimum cleansing velocity
- D. Determining pipe capacity
- E. None of the Above

371. This helps to _____ of the system and alert the operator to problems such as leaks or internal deposits.

- A. Monitor the performance
- B. Constantly evaluate
- C. Cleanse and check the velocity
- D. Determine the pipe capacity
- E. None of the Above

372. It is sometimes advantageous to have certain points in the system continuously monitored to provide a _____.

- A. Pressure tests
- B. Constant evaluation of the system
- C. Minimum cleansing velocity
- D. Determine if pipe capacity
- E. None of the Above

Cross-connection

373. A cross-connection is any temporary or permanent connection between a public water system or consumer's potable (i.e., drinking) water system and any source or system containing _____ water or other substances.

- A. Backsiphonage
- B. Backpressure
- C. Nonpotable
- D. Downstream pressure
- E. None of the Above

374. An example is the piping between a public water system or consumer's potable water system and a(n) _____, cooling system, or irrigation system.

- A. Backsiphonage
- B. Backpressure
- C. Nonpotable
- D. Downstream pressure
- E. None of the Above

375. _____: Any natural or man-made physical, chemical, biological, or radiological substance or matter in water, which is at a level that may have an adverse effect on public health, and which is known or anticipated to occur in public water systems.

- A. CONTAMINANT
- B. CONTAMINATION
- C. CORROSION
- D. CROSS-CONNECTION
- E. None of the Above

376. _____: To make something bad. To pollute or infect something. To reduce the quality of the potable (drinking) water and create an actual hazard to the water supply by poisoning or through spread of diseases.

- A. CONTAMINANT
- B. CONTAMINATION
- C. CORROSION
- D. CROSS-CONNECTION
- E. None of the Above

377. _____: The removal of metal from copper, other metal surfaces and concrete surfaces in a destructive manner. Corrosion is caused by improperly balanced water or excessive water velocity through piping or heat exchangers.

- A. CONTAMINANT
- B. CONTAMINATION
- C. CORROSION
- D. CROSS-CONNECTION
- E. None of the Above

378. _____: A physical connection between a public water system and any source of water or other substance that may lead to contamination of the water provided by the public water system through backflow. This also might be the source of an organic substance causing taste and odor problems in a water distribution system.

- A. CONTAMINANT
- B. CONTAMINATION
- C. CORROSION
- D. CROSS-CONNECTION
- E. None of the Above

379. _____: The mixing of two unlike qualities of water. For example, the mixing of good water with a polluting substance like a chemical substance.

- A. CONTAMINANT
- B. CONTAMINATION
- C. CORROSION
- D. CROSS-CONTAMINATION
- E. None of the Above

Backflow

380. Backflow is the undesirable reversal of flow of nonpotable water or other substances through a cross-connection and into the piping of a public water system or consumer's potable water system. There are two types of backflow--backpressure and _____.

- A. Backsiphonage
- B. Backpressure
- C. Nonpotable
- D. Downstream pressure
- E. None of the Above

Backsiphonage

381. Backsiphonage is backflow caused by a negative pressure (i.e., a vacuum or partial vacuum) in a public water system or consumer's _____ water system.

- A. Backsiphonage
- B. Backpressure
- C. Potable
- D. Downstream pressure
- E. None of the Above

382. Backsiphonage can occur when there is a stoppage of water supply due to nearby fire fighting, a break in a water main, etc. Hoses are the greatest source of _____ problems.

- A. Backsiphonage
- B. Backpressure
- C. Nonpotable waterworks industry
- D. Downstream pressure
- E. None of the Above

Backpressure

383. Backpressure is backflow caused by a _____ that is greater than the upstream or supply pressure in a public water system or consumer's potable water system.

- A. Backsiphonage
- B. Cross-Connections
- C. Nonpotable waterworks industry
- D. Downstream pressure
- E. None of the Above

384. Backpressure (i.e., downstream pressure that is greater than the potable water supply pressure) can result from an increase in _____, a reduction in the potable water supply pressure, or a combination of both.

- A. Backsiphonage
- B. Backpressure
- C. Cross-Connections
- D. Downstream pressure
- E. None of the Above

385. Increases in _____ can be created by pumps, temperature increases in boilers, elevation, etc.

- A. Backsiphonage
- B. Backpressure
- C. Cross-Connections
- D. Downstream pressure
- E. None of the Above

386. Reductions in _____ water supply pressure occur whenever the amount of water being used exceeds the amount of water being supplied, such as during water line flushing, fire fighting, or breaks in water mains.

- A. Backsiphonage
- B. Backpressure
- C. Potable
- D. Downstream pressure
- E. None of the Above

Backflow Review Statements

387. What is a continuous positive pressure in a distribution system is essential for preventing a backflow condition or event?

- A. Backflow Condition
- B. Backflow Prevention
- C. Backflow or Cross-connection Failure
- D. Backflow
- E. None of the Above

388. What might be the source of an organic substance causing taste and odor problems in a water distribution system?

- A. Backflow Condition
- B. Backflow Prevention
- C. Backflow or Cross-connection failure
- D. Backflow
- E. None of the Above

389. To stop or prevent the occurrence of, the unnatural act of reversing the normal direction of the flow of liquid, gases, or solid substances back in to the public potable (drinking) water supply.

- A. Backflow Condition
- B. Backflow Prevention
- C. Backflow or Cross-connection Failure
- D. Backflow
- E. None of the Above

390. Minimum water pressure must be maintained to ensure adequate customer service during peak flow periods. However minimum positive pressure must be maintained in mains to protect against backflow or backsiphonage from cross-connections.

- A. Backflow Condition
- B. Backflow Prevention
- C. Backflow or Cross-connection Failure
- D. Backflow
- E. None of the Above

391. Name the most common CAUSE for public water supply contamination. Backflow or cross-connection. To reverse the natural and normal directional flow of a liquid, gases, or solid substances back into the public potable (drinking) water supply. This is normally an undesirable effect.

- A. Backflow Condition
- B. Backflow Prevention
- C. Backflow or Cross-connection Failure
- D. Backflow
- E. None of the Above

392. What does a backsiphonage condition usually cause?

- A. It must be at least 12 inches above the highest downstream outlet.
- B. Reduced pressure or negative pressure on the service or supply side.
- C. The RP has a relief valve.
- D. A cross-connection.
- E. None of the Above

393. What does a double check valve backflow assembly provide effective protection from?
- It must be at least 12 inches above the highest downstream outlet.
 - Both backpressure and backsiphonage of pollution only.
 - The RP has a relief valve.
 - A cross-connection.
 - None of the Above
394. What is equipment that utilizes water for cooling, lubrication, washing or as a solvent always susceptible to?
- It must be at least 12 inches above the highest downstream outlet.
 - 1 year.
 - The RP has a relief valve.
 - A cross-connection.
 - None of the Above
395. What is the difference between a reduced pressure principle backflow device and a double check backflow device?
- It must be at least 12 inches above the highest downstream outlet.
 - 1 year.
 - The RP has a relief valve.
 - A cross-connection.
 - None of the Above
396. What is the maximum time period between having a backflow device tested by a certified backflow tester?
- It must be at least 12 inches above the highest downstream outlet.
 - 1 year.
 - The RP has a relief valve.
 - A cross-connection.
 - None of the Above
397. What must an operator ensure when installing a pressure vacuum breaker backflow device?
- It must be at least 12 inches above the highest downstream outlet.
 - 1 year.
 - The RP has a relief valve.
 - A cross-connection.
 - None of the Above

Approved Air Gap Separation (AG)

398. An approved air gap is a(n) _____ between the free flowing discharge end of a potable water supply pipeline, and the overflow rim of an open or non pressure receiving vessel.
- Physical separation
 - Air flow restricted
 - Least twice the inside diameter of the inlet pipe
 - Obstruction
 - None of the Above
399. These separations must be _____ a distance of at least twice the inside diameter of the inlet pipe, but never less than one inch.
- Air gap
 - Gapped
 - Least twice the inside diameter of the inlet pipe
 - No obstruction
 - None of the Above

400. An example is the piping between a public water system or consumer's potable water system and a(n) _____, cooling system, or irrigation system.

- A. Backsiphonage situation
- B. Backpressure situation
- C. Nonpotable connection
- D. Potential downstream pressure
- E. None of the Above

You are finished with your assignment; please complete the Registration page and the Customer Survey sheet on the rear page. You can fax this information to us.

"For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life. For God did not send his Son into the world to condemn the world, but to save the world through him.

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