Registration form

Flocculation and Coagulation Course $200.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL $50.00

Start and Finish Dates: _____
You will have 90 days from this date in order to complete this course

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

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

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

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Flocculation and Coagulation Answer Key

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

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

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

FLOCCULATION AND COAGULATION CEU COURSE CUSTOMER SERVICE RESPONSE CARD

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

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Flocculation and Coagulation CEU Training Course Assignment

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

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

Safe Drinking Water Act (SWDA)
National Drinking Water Regulations
Contaminant Selection

1. The law also includes a schedule for the EPA to complete regulations for disinfectants and disinfection byproducts (D/DBPs) and Copper.

A. True B. False

Standard Setting

2. For each contaminant that the EPA has determined merits regulation, the EPA must set a non-enforceable action level at a level at which no known or anticipated recommended health effects occur, and which allows an adequate margin of safety.

A. True B. False

State Primacy

3. The primary enforcement responsibility for public water systems lies with the states, provided they adopt regulations as stringent as the national requirements, adopt authority for administrative penalties, develop adequate procedures for enforcement, maintain records, and create a plan for providing emergency water supplies.

A. True B. False

Nonprimacy State

4. Primacy states may establish alternative monitoring requirements to provide interim monitoring relief for systems serving 10,000 or fewer persons for most contaminants, if a contaminant is not detected in the first quarterly sample.

A. True B. False

Preliminary Treatment

5. If not removed, weeds, leaves, and trash will cause problems to the treatment plant's pumps and equipment, the best way to protect the plant is?

A. Screening
B. Settling
C. Coagulation
D. Change source
E. Pump groundwater
F. None of the Above

6. Mechanical bar screens vary in size and use some type of raking mechanism that travels horizontally down the bars to scrap the debris off.
A. True B. False

7. Bar screens and wire mesh screens both require _____.
A. Manual cleaning D. Replacement
B. Automatic cleaning E. A and B
C. No cleaning F. None of the Above

Pre-Sedimentation
8. A rectangular clarifier has scrapers on the bottom to move the settled sludge to one or more hoppers at the influent end of the tank. It could also have _____ or traveling bridge used to collect the sludge.
A. A screw conveyor D. Manual skimmers
B. Conveyor belts E. Turnstile
C. Dissolved air floatation F. None of the Above

9. Sedimentation basins are used after the flocculation process.
A. True B. False

10. Most rectangular clarifiers will have baffles to prevent backflow from entering the effluent.
A. True B. False

11. Sand and grit will damage plant equipment and pipes, so it must be removed with either rectangular or round-shaped basin prior to?
A. Filtration D. Flocculation
B. Coagulation E. Sedimentation basin(s)
C. Purification F. None of the Above

Flights and Chains
12. Flights and chains remove the scum from the _____ of the basin.
A. Supernatant D. Armature
B. Surface E. A and B
C. Scum box F. None of the Above

13. To prevent damage to the flights and chains due to overloads, a _____is used.
A. Bearing D. Safety net
B. Reducer E. A and B
C. Shear pin F. None of the Above

14. The flights are usually concrete flights mounted on parallel chains and the motor shaft is connected through a shaft that turns the gear.
A. True B. False

Circular Clarifiers
15. The most common type of circular clarifier has a center pier or column.
A. True B. False

Conventional Treatment Overview & Direct Filtration

16. The _____ process uses alum and cationic polymers to neutralize the charge.
A. Filtration D. Flocculation
B. Reconditioning E. Conventional
C. Purification F. None of the Above

17. Which of the following compounds combines with alkalinity in the **r**aw water to form a white precipitate that neutralizes suspended particles' electrical charge?
A. Activated sodium D. Dissolved organic carbon
B. PAC E. Alum
C. Activated carbon F. None of the Above

18. _____ uses a 30 to 50 mg/L alum dosage to form a large floc that requires extensive retention time to permit settling.
A. Conventional technology D. All of the above except C
B. Reconditioning cycle E. Chemical pretreatment
C. Traditional sand filter F. None of the Above

19. According to the text, when the pressure difference between filter inlet and outlet increases by 5 - 10 psi from the beginning of the cycle, the filter should be reconditioned. Operating beyond this pressure drop increases the chance of fouling - called " mud-balling " - within the filter.
A. True B. False

20. The _____ consists of an up-flow backwash followed by a down-flow rinse.
A. Conventional technology D. Fast rinse
B. Reconditioning cycle E. Chemical pretreatment
C. Traditional F. None of the Above

21. Which part of the reconditioning cycle lasts about 5 to 10 minutes?
A. Conventional technology D. Fast rinse
B. Reconditioning cycle E. Chemical pretreatment
C. Traditional F. None of the Above

22. _____ is often used to enhance filter performance.
A. Conventional technology D. Fast rinse
B. Reconditioning cycle E. Chemical pretreatment
C. Traditional F. None of the Above

23. Feeding chemicals such as alum, ferric chloride, or a cationic polymer neutralizes the charge, allowing the particles to cling to one another and to the filter media.
A. True B. False

24. _____ may increase filtered water clarity, measured in NTU, by 90% compared with filtration alone.
A. Conventional technology D. Fast rinse
B. Reconditioning cycle E. Chemical pretreatment
C. Traditional F. None of the Above

25. According to the text, if an operator is present to make adjustments for variations in the sedimentation process, clarity improvements in the range of 93 to 95% are achievable.
A. True B. False

Direct Filtration Plant vs. Conventional Plant

26. The only difference between the Direct Filtration plant and the Conventional plant is that the _____ or step is omitted from the Direct Filtration plant.
A. Conventional technology
B. Reconditioning cycle
C. Sedimentation process
D. Fast rinse
E. Chemical pretreatment
F. None of the Above

Rapid Sand Filtration

27. _____ is the most prevalent form of water treatment technology in use today.
A. Conventional technology
B. Reconditioning cycle
C. Sedimentation process
D. Rapid Sand filtration
E. Chemical pretreatment
F. None of the Above

28. The Rapid Sand filtration process employs a combination of _____ in order to achieve maximum effectiveness.
A. Filtration
B. Aluminum Sulfate
C. Chemical pretreatment
D. Sedimentation process
E. Physical and chemical processes
F. None of the Above

Coagulation

29. At the water treatment plant, alum is added to the water in the "flash mix" to cause microscopic impurities in the water to clump together.
A. True B. False

30. The alum and the water are mixed rapidly by the _____.
A. Cationic polymers
B. Flash mixer
C. Coagulant chemicals
D. Shaker
E. All of the Above
F. None of the Above

31. What is the process of joining together particles in water to help remove organic matter called?
A. Cationic polymers
B. Coagulation
C. Coagulant chemicals
D. Flocculation
E. All of the Above
F. None of the Above

32. _____ are so small, their charge per volume is significant?
A. Cationic polymers
B. Colloidal particles
C. Coagulant chemicals
D. Aluminum Sulfate molecules
E. All of the Above
F. None of the Above

33. Coagulation is necessary to meet the current regulations for almost all potable water plants using surface water.
A. True B. False

34. Coagulant chemicals such as "alum" work by neutralizing the negative charge, which allows the particles to come together.
A. True B. False

35. Which coagulants can be thought of as positively charged strings that attract the particles to them, and in the process, form a larger particle?
A. Cationic polymers D. Lime
B. Coagulation helpers E. All of the Above
C. Salts F. None of the Above

36. Aluminum Sulfate is also excellent for removing nutrients such as phosphorous in wastewater treatment.
A. True B. False

37. Fine particles must be coagulated, or "stuck together" to form larger particles that can be filtered, this is achieved through the use of _____.
A. Sedimentation D. Flocculation
B. Coagulation E. All of the Above
C. Coagulant chemicals F. None of the Above

38. _____ are required since colloidal particles by themselves have the tendency to stay suspended in water and not settle out?
A. Cationic polymers D. Flocculation
B. Coagulation E. All of the Above
C. Coagulant chemicals F. None of the Above

39. New chemicals have been developed which combine the properties of alum-type coagulants and _____.
A. Cationic polymers D. Ammonia Hydroxide
B. Chlorine E. All of the Above
C. Salts F. None of the Above

40. _____ is the most widely used coagulant in water treatment?
A. Cationic polymers D. Aluminum Sulfate
B. Coagulation helpers E. Soda ash
C. Salts F. None of the Above

41. Liquid _____is a 48.86% solution.
A. Cationic polymers D. Aluminum Sulfate
B. Ammonia Hydroxide E. Soda ash
C. Salts F. None of the Above

42. In water treatment, large microorganisms, including algae and amoebic cysts, are readily removed by _____ and filtration.
A. Cationic polymers D. Coagulation
B. Coagulation helpers E. All of the Above
C. Salts F. None of the Above

43. More than 98% of poliovirus type 1 was removed by conventional _____ and filtration.

A. Cationic polymers
B. Coagulation helpers
C. Salts
D. Coagulation
E. All of the Above
F. None of the Above

Flocculation

44. The water is slowly mixed in contact chambers allowing the coagulated particles, now, called "floc," to become larger and stronger.

A. True B. False

45. As these _____ in the water, bacteria and other microorganisms are caught in the floc structure.

A. Equalize the basin
B. Agitate the water
C. Floc particles mix
D. Coagulated particles
E. All of the Above
F. None of the Above

46. Flocculation is the process of bringing together destabilized or coagulated particles to form larger masses which can be settled and/or filtered out of the water being treated.

A. True B. False

47. In the flocculation process, the suspended particles can collide, _____, and form heavier particles called “floc”.

A. Equalization
B. Agitation of the water
C. Agglomerate
D. Destabilized or coagulated particles
E. All of the Above
F. None of the Above

48. Gentle _____ and appropriate detention times (the length of time water remains in the basin) help facilitate the flocculation process.

A. Equalizing
B. Agitation of the water
C. Agglomerating
D. Settling
E. All of the Above
F. None of the Above

Pre-Sedimentation

49. Depending on the quality of the source water, some plants have pre-sedimentation, which allows larger _____ in a reservoir or lake reducing solid removal loads.

A. Equalize the basin
B. Agitate the water
C. Floc particles mix
D. Coagulated particles
E. Particles time to settle
F. None of the Above

Sedimentation

50. Sedimentation is the process of destabilizing coagulated particles in water.

A. True B. False

51. Following _____, a sedimentation step may be used.

A. Conventional technology
B. Flocculation
C. Sedimentation process
D. Rapid Sand filtration
E. Chemical pretreatment
F. None of the Above

52. Once settled, the _____ that is later removed from the bottom of the basin.
A. Basin is equalized D. Particles combine to form a sludge
B. Water is agitated E. Particles settle over time
C. Floc particles mix F. None of the Above

Filtration
53. Filtration is a water treatment step used to remove turbidity, dissolved organics, odor, taste and color.
A. True B. False

54. The filter is periodically cleaned by a reversal of flow and the _____ into a drain.
A. Activated carbon filters D. Rapid-sand filters
B. Cartridge filters E. Discharge of back-flushed water
C. Anthracite coal F. None of the Above

55. _____ are made of fabric, paper, or plastic material.
A. Activated carbon filters D. Rapid-sand filters
B. Cartridge filters E. Granular synthetic filters
C. Anthracite filters F. None of the Above

56. _____ will also remove turbidity, but would not be recommended for that purpose only.
A. Activated carbon filters D. Rapid-sand filters
B. Cartridge filters E. Granular synthetic material
C. Anthracite coal F. None of the Above

57. At a rate of between 2 and 10 gpm per square foot, the water is filtered through an approximate 36" depth of graded sand.
A. True B. False

58. The water flows by gravity through large filters of_____, silica sand, garnet and gravel.
A. Activated carbon filters D. Rapid-sand filters
B. Cartridge filters E. All of the Above
C. Anthracite coal F. None of the Above

59. Filters for suspended particle removal can also be made of graded sand, _____, screens of various materials, and fabrics.
A. Activated carbon filters D. Rapid-sand filters
B. Cartridge filters E. Granular synthetic material
C. Anthracite coal F. None of the Above

60. Evaluation of overall _____ should be conducted on a routine basis, at least once per day.
A. Wall scum D. Post-disinfection
B. Gate position E. Filtration process performance
C. Effluent control measurement F. None of the Above

61. Good chemical treatment can often result in either early turbidity breakthrough or rapid head loss buildup.
A. True B. False

62. The most widely used filters are _____ in tanks. In these units, gravity holds the material in place and the flow is downward.
A. Activated carbon filters
B. Cartridge filters
C. Anthracite coal
D. Rapid-sand filters
E. Granular synthetic material
F. None of the Above

63. For the removal of organic contaminants and taste and odor problems, anthracite coal or _____ may also be included in the sand to improve the filtration process,
A. Sand
B. Garnet
C. Activated carbon
D. Post-disinfection
E. All of the Above
F. None of the Above

Declining Rate Filters
64. The flow rate will vary with_____.
A. Head loss
B. Uniform media
C. Effluent control
D. Post-disinfection
E. All of the Above
F. None of the Above

65. The declining rate filters system requires _____ to provide adequate media submergence.
A. Head loss
B. Uniform media
C. Effluent control structure
D. Post-disinfection
E. Flocculation
F. None of the Above

Detention Time
66. Detention time is the actual time required for a small amount of water to pass through a sedimentation basin at a given rate of flow, or the calculated time required for a small amount of liquid to pass through a tank at a given rate of flow.
A. True B. False

Disinfection
67. Chlorine is added to the water at the flash mix for pre-disinfection. The chlorine kills or inactivates harmful microorganisms.
A. True B. False

68. Chlorine is added again after filtration for_____.
A. Residual
B. Control THMS
C. Contact time
D. Post-disinfection
E. Pre-disinfection
F. None of the Above

Jar Testing
69. Jar testing traditionally has been done on a monthly basis in most water treatment plants to control THMs.
A. True B. False

pH

70. pH is an expression of a basic or acid condition of a liquid. The range is from 0-14, zero being the most acid and 14 being the most alkaline. A pH of 7 is considered to be neutral.

A. True B. False

71. Most _____ has a pH between 6.0 and 8.5.

A. Treated water
B. Disinfectants
C. Natural water
D. All of the Above
E. Chlorine
F. None of the above

Caustic

72. NaOH is a strong chemical used in the treatment process to neutralize acidity, and to lower the pH value.

A. True B. False

Polymer

73. Polymer is a water treatment chemical that**,** when combined with other types of coagulants, aids in binding small _____ to larger particles to help in the settling and filtering processes.

A. Excess floc
B. Coagulants
C. Suspended particles
D. Color
E. Solids
F. None of the Above

Post-Chlorine

74. The operator should make sure that the chlorinated water holds a residual in the distribution system.

A. True B. False

Pre-Chlorination

75. Before the filtration process, chlorination will help: control fish and vegetation. The addition of chlorine before the filtration process will help: control fish and vegetation.

A. True B. False

Hydrofluosilicic Acid

76. H_2SiF_6 is a clear**,** _____**,** with a pH ranging from 1 to 1.5 and **is** used in water treatment to fluoridate drinking water.

A. Gas
B. But colored liquid
C. Fluoridating drinking water liquid
D. Fuming corrosive liquid
E. Dark pleasant liquid
F. None of the Above

Corrosion Control

77. The pH of the water is adjusted with_____.

A. Acid
B. Sodium carbonate
C. Fluoride acid
E. Soda acid
D. Subsequent treatment processes
F. None of the Above

78. Which of the following chemicals is fed into the water after filtration?

A. Acid
B. Sodium Chloride
C. Fluoride acid
E. Soda ash
D. Subsequent treatment processes
F. None of the Above

Taste and Odor Control

79. Which of the following chemicals is occasionally added for taste and odor control?

A. Turbidity powder
B. Powdered activated carbon (PAC)
C. Fluoride
D. HOCL
E. All of the Above
F. None of the Above

Water Quality

80. Water quality testing is conducted throughout the water treatment process.

A. True B. False

81. Water quality testing needs to analyze turbidity, pH, and chlorine residual continuously.

A. True B. False

82. Some water quality items are tested several times per day, some once per quarter and others once per year.

A. True B. False

Chemical Feed and Rapid Mix

83. To improve the subsequent treatment processes, chemicals are added to the water, and may include pH adjusters and coagulants.
This question is ok.

A. True B. False

84. Coagulants are chemicals, such as alum, that neutralize positive or negative charges on small particles, allowing them to stick together and form larger particles that are more easily removed by sedimentation or filtration.

A. True B. False

Short-Circuiting

85. Short-Circuiting is a condition that occurs in tanks or basins when some of the water travels faster than the rest of the flowing water.

A. True B. False

86. Short-Circuiting is usually undesirable, since it may result in shorter contact, reaction, or settling times in comparison with the_____.

A. Presumed detention times
B. Sedimentation/clarification process
C. Modification of the conventional process
D. Up-flow clarifier
E. All of the Above
F. None of the Above

Tube Settlers

87. Tube settlers are a modification of the conventional process that contains many metal “tubes” that are placed in the _____.

A. Clearwell
B. Sedimentation basin or clarifier
C. Flocculation basin
D. An up-flow clarifier
E. Filter
F. None of the Above

88. The slope of the tubes facilitates gravity settling of the solids to the bottom of the basin, where they can be _____.
A. Adjusted for detention times
B. Sampled
C. Collected and removed
D. Modified
E. Used for the sedimentation/clarification process
F. None of the Above

89. The large surface settling area also means that adequate clarification can be obtained with detention times of 45 minutes or more.
A. True B. False

90. As with conventional treatment, the tube settler sedimentation step is followed by ____.
A. Filtration through mixed media.
B. Reconditioning cycle
C. Traditional sand filter
D. Coagulation
E. Chemical pretreatment
F. None of the Above

Adsorption Clarifiers

91. In this sedimentation/clarification process, turbidity is _____ of the coagulated and flocculated solids onto the adsorption media and onto the solids already adsorbed onto the media.
A. Increased by adsorption
B. Reduced by adsorption
C. Destroyed
D. Decreased
E. A modification of the conventional process
F. None of the Above

92. Water scouring cleans adsorption clarifiers followed by air flushing
A. True B. False

93. Cleaning of the clarifier is initiated less often than filter backwashing because the clarifier removes less solids.
A. True B. False

94. As with the **t**ube-settler type of package plant, the **s**edimentation/clarification process is followed by mixed-media filtration and disinfection to complete the water treatment.
A. True B. False

Clearwell

95. The clearwell provides temporary storage for the treated water, which is the final step in the conventional filtration process.
A. True B. False

EPA Filter Backwash Rule

96. The _____ will reduce the potential risks associated with recycling contaminants removed during the filtration process.
A. Enforceable standards
B. Filter backwash requirements
C. Influence of surface water
D. Increase protection of finished drinking water
E. Filtration and disinfection rules
F. None of the Above

97. The U.S. Environmental Protection Agency has finalized the Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule to _____ from contamination by Cryptosporidium and other microbial pathogens.
A. Enforce standards to protect
B. Increase filtration and disinfection
C. Increase protection of finished drinking water supplies
D. Remove
E. All of the Above
F. None of the Above

98. Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule will apply to public water systems using surface water or ground water under the direct
A. Enforceable standards
B. Filtration and disinfection rules
C. Influence of surface water
D. Groundwater
E. All of the Above
F. None of the Above

Background
99. The EPA has determined that the presence of microbiological contaminants is a health concern. If finished water supplies contain _____, disease outbreaks may result.
A. Disease symptoms
B. Cryptosporidium
C. Waterborne diseases
D. Microbiological contaminants
E. All of the Above
F. None of the Above

Turbidity
100. _____ must comply with specific combined filter effluent turbidity requirements.
A. Watershed control
B. Raw water control
C. Disinfection profile
D. Disinfection benchmark
E. Conventional and Direct filtration systems
F. None of the Above

101. Conventional and _____must comply with individual filter turbidity requirements.
A. Groundwater
B. Direct filtration systems
C. Disinfection processes
D. Raw water
E. A and D
F. None of the Above

The Filtration Process
102. Removal of _____ plays an important role in the natural treatment of groundwater as it percolates through the soil.
A. Coagulation and flocculation processes
B. Coagulation or oxidation processes
C. Serious problems in filter operation
D. Suspended solids by filtration
E. A and D
F. None of the Above

103. Groundwater that has been softened or treated through iron and manganese removal will require filtration to remove floc created by?_____,
A. Coagulation and flocculation
B. Coagulation or oxidation processes
C. Serious problems in filter operation
D. A combination of complex physical and chemical mechanisms
E. Suspension
F. None of the Above

104. According to the text, since surface water sources are subject to run-off and do not undergo natural filtration, it must be filtered to?_____.
A. Aid the coagulation and flocculation processes
B. Provide coagulation or oxidation processes
C. Remove particles and impurities
D. Retain the combination of complex physical and chemical mechanisms
E. Standards
F. None of the Above

105. The filter used in the filtration process can be compared to a _____ that traps suspended material between the grains of filter media.
A. Coagulation and flocculation
B. Coagulation or oxidation processes
C. Sieve or microstrainer
D. Physical and chemical mechanisms
E. Treatment process
F. None of the Above

106. Since most _____ through the spaces between the grains of the filter media, straining is the least important process in filtration.
A. Suspended particles can easily pass
B. Coagulation passes
C. Serious problems in filter operation passes
D. Turbidity passes
E. Mudballing
F. None of the Above

107. Filtration primarily depends on a _____, the most important being adsorption.
A. Coagulation and flocculation process
B. Coagulation or oxidation processes
C. Serious problems in filter operation
D. Combination of complex physical and chemical mechanisms
E. A and D
F. None of the Above

108. Adsorption is the process of particles sticking onto the surface of the individual filter grains or onto the previously deposited materials. The forces that attract and hold the particles to the grains are the same as those that work._____.
A. Coagulation and flocculation
B. Coagulation or oxidation processes
C. Main filter
D. Complex physical and chemical mechanisms
E. A and B
F. None of the Above

109. _____, especially if coagulation and flocculation of the water before filtration was not properly controlled.
A. Some coagulation and flocculation may occur in the filter bed
B. Coagulation or oxidation processes will work
C. No problems in filter operation
D. Physical and chemical mechanisms will improve
E. A and B
F. None of the Above

Types of Filters
110. The earliest water filters developed were the slow sand filters**.** They have filter rates of around 0.05 gpm/ft^2 of surface area. This type of filter requires large filter areas.
A. True B. False

111. What is the term for the mass of growing material that collects on the surface of the filter?
A. Schmutzdecke D. Mud balls
B. Water moss E. Zoological growth
C. Backwash F. None of the Above

112. Most water filters are classified by filtration rate, type of _____, or type of operation.
A. Schmutzdecke D. Filter media
B. Slow rate filtration E. Filter size
C. Backwash capabilities F. None of the Above

Rapid Sand Filters
113. Rapid sand filters can accommodate filter rates 40 times more than those of_____.
A. Fixed film D. Activated carbon beds
B. Slow sand filters E. Without sand
C. Mixed media F. None of the Above

114. Filters in large water treatment plants are usually constructed next to each other in a row, allowing the piping from the sedimentation basins to feed the filters from a central pipe gallery.
A. True B. False

Filter Sand
115. The filter sand used in rapid sand filters is normal play sand for the purpose of water filtration.
A. True B. False

116. The gravel installed under the sand layer(s) in the filter prevents the _____ from being lost during the operation.
A. Rapid filters D. Sedimentation basin
B. Filter sand E. Mixed media
C. Backwash trough F. None of the Above

117. This under-gravel supports the filter sand and is usually graded in three to five layers, each generally 6-18 inches in thickness, depending on the type of underdrain used.
A. True B. False

118. Most _____ contain 24-30 inches of sand, but some newer filters are deeper.
A. Rapid sand filters D. Sedimentation basin
B. Slow rate filtration E. Mixed media
C. Backwash trough F. None of the Above

119. According to the text, the coarser sand in the _____ has larger voids that do not fill as easily.
A. Rapid filters D. Sedimentation basin
B. Slow rate filtration E. Mixed media
C. Backwash trough F. None of the Above

False floor
120. The false floor design of a _____ is used together with a porous plate design or with screens that retain the sand when there is no undergravel layer.
A. Rapid sand filter system D. Filter underdrain
B. Slow rate filtration system E. Leopold system
C. Backwash system F. None of the Above

121. This type of underdrains allows the jet action or open space under the floor to act as the collection area for the filtered water and of the filter backwash water.
A. True B. False

Leopold System
122. According to the text, the Leopold system consists of a series of clay or plastic blocks that form the channels to remove the filtered water from the filter and distribute the~~?~~
A. Backwash water D. Backwashing of the filter or backwash cycle
B. Surface wash system E. Removed filtered water
C. Media F. None of the Above

Surface Wash
123. During the operation of a filter, the upper six-to-ten inches of the filter media remove most of the suspended material from the water. It is important that this layer is thoroughly cleaned during the _____.
A. Rinsing cycle D. Backwash cycle
B. Method of agitation E. Filtered water cycle
C. Washing F. None of the Above

124. Normal backwashing does not, in most cases, clean this layer completely; therefore, some _____ is needed to break up the top layers of the filter and to help the backwash water remove any material caught there.

A. Rinsing cycle
B. Method of agitation
C. Washing
D. Backwash cycle
E. Surface wash
F. None of the Above

125. A newer design of _____ uses compressed air to mix the upper layer and loosen the particles from the sand so that the backwash water can remove the particles more easily.

A. Rinsing cycle
B. Method of agitation
C. Washing
D. Backwash cycle
E. Surface wash
F. None of the Above

Washwater Troughs

126. Washwater troughs placed above the filter media collect the _____and carry it to the drain system.

A. Backwash water
B. Raw water
C. Media
D. Rinsing of the filter or backwash cycle
E. Rinsate
F. None of the Above

127. Proper placement of these troughs is very important to ensure that the filter media is not carried into the troughs during the _____ and removed from the filter.

A. Backwash
B. Raw water
C. Media
D. Mudballs
E. Rinsate
F. None of the Above

128. Wash troughs must be installed at the same elevation so that they remove the _____ evenly from the filter and so that an even head is maintained across the entire filter.

A. Backwash
B. Raw water
C. Media
D. Mudballs
E. Rinsate
F. None of the Above

129. Which of the following filter components are constructed from concrete, plastic, fiberglass, or other corrosion-resistant materials?

A. Backwash troughs
B. Surface wash system piping
C. False floor
D. Trap door
E. Center stand
F. None of the Above

Diatomaceous Earth Filter

130. The Diatomaceous Earth Filter process was developed by the military during World War II to remove microorganisms that cause amoebic dysentery from water used in the field.

A. True B. False

Filtration Processes

131. Dual and multi-media filters are used with conventional filtration.

A. True B. False

132. _____ plants have a lower capital cost. However, the process cannot handle large variations is raw water turbidity.

A. Direct Filtration
B. Dual and multi-media filtration
C. Conventional Filtration
D. Flocculation
E. Sand Filtration
F. None of the Above

High Rate Filters

133. High rate filters, which operate at a rate _____, use a combination of different filter media, not just sand.

A. That finer material are farther down
B. Faster than 3 feet per second
C. Of 2 feet per second
D. Three-to-four times that of rapid sand filters
E. All of the Above
F. None of the Above

134. Multi-media or mixed-media filters use three or four different materials, generally sand, anthracite coal, and garnet.

A. True B. False

135. In rapid sand filters, finer sand grains are at the _____ farther down into the filter, in rapid sand filters.

A. Bottom of the sand layer with larger grains
B. Top of the sand layer with larger grains
C. Front of the sand layer with larger grains
D. End of the sand layer
E. Top of the sand layer with finer grains
F. None of the Above

136. In the high rate filter, the top layers consist of a fine material with the course material farther down, allowing the suspended material to penetrate less into the filter.

A. True B. False

137. The filter bed material forms layers in the filter, depending on their weight and specific gravities.

A. True B. False

Pressure Sand Filters

138. Pressure filtration rates are twice as good as gravity filters.

A. True B. False

139. Which type of filter is commonly used for iron and manganese removal from groundwater?

A. Slow sand/RO
B. Gravity filters
C. Pressure sand filter
D. Fast sand
E. Conventional
F. None of the Above

140. Cracking of the filter bed can occur quite easily in _____, allowing the iron and manganese particles to go straight through the filter?

A. Slow sand/RO
B. Gravity filters
C. Pressure filters
D. Fast sand
E. Conventional
F. None of the Above

141. A _____ is contained under pressure in a steel tank.
A. Slow sand/RO
B. Gravity filter
C. Pressure sand filter
D. Fast sand
E. Conventional
F. None of the Above

142. The media in a _____ is usually sand or a combination of media.
A. Slow sand/RO
B. Gravity filters
C. Pressure sand filter
D. Fast sand
E. Fixed film
F. None of the Above

143. Because the water in a pressure sand filter is under pressure, _____ will not occur in the filter.
A. Gravity
B. Velocity
C. Air binding
D. Flow
E. Heat
F. None of the Above

144. _____ have a major disadvantage in that the backwash cannot be observed.
A. Slow sand/RO
B. Gravity filters
C. Pressure filters
D. Fast sand
E. Conventional
F. None of the Above

145. _____ have limitations, and therefore must not be used to treat surface water.
A. Slow sand/RO
B. Gravity filters
C. Pressure filters
D. Fast sand
E. Conventional
F. None of the Above

Filtration Operation

146. Filtration operation is divided into three steps: filtering, backwashing, and~~?~~ _____.
A. Filter run
B. Filtering to waste
C. Return to waste
D. Drying
E. Rinsate
F. None of the Above

Water Quality Key Words

147. _____ is a low pressure membrane filtration process that removes suspended solids and colloids generally larger than 0.1-micron diameter.
A. Nanofiltration
B. Pressure recovery
C. Microfiltration
D. Semi-permeable
E. Declining rate
F. None of the Above

148. _____ is a relatively recent membrane process used most often with low total dissolved solids water such as surface water and fresh groundwater.
A. Nanofiltration
B. Pressure recovery
C. Microfiltration
D. Semi-permeable
E. Declining rate
F. None of the Above

Filtration Operation - Declining Rate

149. Which method of control is used where the head loss through the plant is quite large?

A. Slow sand/RO
B. Gravity filters
C. Pressure filters
D. Fast sand
E. Declining Rate
F. None of the Above

150. The rate through the declining rate filter is much greater in the beginning of a filter run than at the end when the_____.

A. Filter run
B. Filter is dirty
C. Head loss is low
D. Flow tube controller is operating
E. All of the Above
F. None of the Above

151. Which method of control allows the filter head to increase until the filter becomes plugged with particles and the **h**ead loss is too great to continue operation of the filter?

A. Slow sand/RO
B. Gravity filters
C. Pressure filters
D. Fast sand
E. Declining Rate
F. None of the Above

Loss of Head Indicator

152. Usually the difference in the _____ is measured by a piezometer connected to the filter above the media and the effluent line.

A. Filter run
B. Filtering to waste
C. Flow tube controller
D. Head loss
E. Head
F. None of the Above

153. As filtration proceeds, an increasing amount of pressure, called _____ across the filter, is required to force the water through the filter.

A. Filter run
B. Filtering to waste
C. Flow tube controller
D. Head loss
E. Head
F. None of the Above

154. Which of the following parameters should be continuously measured to help determine when the filter should be backwashed?

A. Filter run
B. Filtering to waste
C. Flow tube controller
D. Head loss
E. Head
F. None of the Above

In-line Turbidimeter

155. Continuous turbidity monitors provide information about when the filter is approaching this point so that the operators can start the backwash before the turbidity is too great.

A. True B. False

156. _____in water is caused by small suspended particles that scatter or reflect light.

A. Shelter bacteria
B. Suspended material
C. Turbidity
D. Floc
E. Breakthrough
F. None of the Above

157. _____ of the filtered water may shelter bacteria, preventing chlorine from reaching it.
A. Shelter bacteria D. Floc
B. Suspended material E. Breakthrough
C. Turbidity F. None of the Above

158. The _____ of the filtered water is one of the factors that determine the length of a filter run.
A. Shelter bacteria D. Floc
B. Suspended material E. Breakthrough
C. Turbidity F. None of the Above

159. _____ measurements will also indicate whether the coagulation and other treatment processes are operating properly.
A. Shelter bacteria D. Floc
B. Suspended material E. Breakthrough
C. Turbidity F. None of the Above

Filtration Process
160. A rapid sand filter will have a flow of two-to-three gpm/square foot of filter area. The high rate filter may have four-to-six gpm/square foot applied to the surface.
A. True B. False

161. Water from the source or from pre-treatment processes**,** is applied to the top of the filter; it then flows downward. The water level above the filter bed is usually kept at two-to-six feet.
A. True B. False

162. When the filtration is started after being backwashed, there will be great head loss.
A. True B. False

163. In filters with a control valve installed on the filter effluent pipe, the _____ is restricted during this time (when the filter is started after backwashing).
A. Shelter bacteria
B. Suspended material
C. Turbidity
D. Filter flow
E. All of the above except D
F. None of the Above

164. The control valve prevents filter surges, which could disturb the media and force _____ through the filter.
A. Flow D. Floc
B. Suspended material E. Breakthrough
C. Dissolved solids F. None of the Above

165. The rate of _____ on a filter depends on the type of filter.
A. Flow D. Floc
B. Suspended material E. Breakthrough
C. Turbidity F. None of the Above

166. A _____ is almost fully closed when a filter is clean so that the desired water level on top of the filter is maintained.
A. Headloss valve
B. Constant rate flow valve
C. Flow restrictor
D. Backwash cycle valve
E. Variable declining rate flow control
F. None of the Above

167. As the filter becomes dirty with suspended material, the valve opens gradually until the increase in the water level above the filter indicates that the filter needs_____.
A. Headloss correction
B. Constant rate flow
C. Flow restrictor adjusting
D. Filtration
E. Backwashing
F. None of the Above

168. In filters with _____, the filters are allowed to take on as much water as they can handle.
A. Headloss valve
B. Constant rate flow valve
C. Flow restrictor
D. Backwash cycle valve
E. Variable declining rate flow control
F. None of the Above

169. As the filter becomes dirty, the flow through the filter becomes less and, if the plant has more than one filter additional _____across the other filters.
A. Headloss
B. Flow redistributes
C. Flow restricting
D. Backwash cycle
E. Media
F. None of the Above

170. A _____ is placed in the filter effluent pipe to prevent a filter inflow that is too great for the filter.
A. Headloss
B. Flow redistributes
C. Flow
D. Backwash cycle
E. Flow restrictor
F. None of the Above

171. The filter eventually fills with suspended material**.** At some time, usually after 15 to 30 hours, it will need to be _____ to clean the media.
A. Bumped
B. Jetted
C. Air scoured
D. Backwashed
E. Flow restrictor
F. None of the Above

Back Washing
172. A normal backwash rate is between 1.2 to 1.5 gpm per square foot of filter surface area.
A. True B. False

173. Proper backwashing is a very important step in the operation of a filter.
A. True B. False

174. The filter will eventually develop additional operational problems~~,~~ if the filter is not _____ completely,
A. Bumped
B. Jetted
C. Air scoured
D. Backwashed
E. Flow restrictor
F. None of the Above

175. The filter must be cleaned before the next filter run**.** Treated water from storage is used for the backwash cycle. This treated water is taken from elevated storage tanks or pumped in from the raw water reservoir.
A. True B. False

176. The _____ must be expanded to clean the filter during the backwash.
A. Headloss D. Backwash cycle
B. Floc(s) E. Media
C. Flow restricting F. None of the Above

177. Filter media expansion causes the filter grains to violently rub against each other, dislodging the _____ from the media.
A. Headloss D. Backwash cycle
B. Floc(s) E. Media
C. Flow restricting F. None of the Above

178. The filter backwash rate has to be great enough to expand and agitate the filter media and suspend the_____ in the water for removal.
A. Headloss D. Backwash cycle
B. Floc(s) E. Media
C. Flow restricting F. None of the Above

179. If the filter _____ is too high, media will be washed from the filter into the troughs and out of the filter.
A. Headloss D. Backwash rate
B. Floc(s) E. Media
C. Flow restricting F. None of the Above

180. During filter backwash, the media expands upwards and around the washing arms.
A. True B. False

181. A newer method of surface wash involves using_____before the water wash.
A. Headloss calculation D. Backwash cycle
B. Floc(s) scouring E. Air washing
C. Air scour F. None of the Above

182. The normal design for the _____ will be two-to-five cubic feet of air per square foot of filter area.
A. Headloss calculation D. Backwash cycle
B. Floc(s) scouring E. Air wash~~ing~~
C. Air scour F. None of the Above

183. The filter should be backwashed when the _____ is so high that the filter no longer produces water at the desired rate.
A. Headloss D. Backwash rate
B. Floc(s) E. Flow rate
C. Flow restricting F. None of the Above

184. The filter should be backwashed when _____ starts to break through the filter and the turbidity in the filter effluent increases.
A. Headloss
B. Floc(s)
C. Flow
D. Backwash rate
E. Media
F. None of the Above

185. If a filter is taken out of service for some reason, it does not need to backwashed prior to be putting on line.
A. True B. False

186. If a filter is not backwashed until the headloss exceeds a certain number of feet, the turbidity may break through and cause the filter to exceed the standard of 0.5 NTU of turbidity.
A. True B. False

187. Depending on filter effluent-turbidity alone can cause high head loss and decreased filter flow rate, which can cause the pressure in the filter to drop below atmospheric pressure and cause the filter to _____and stop filtering.
A. Prevent headloss
B. Air bind
C. Assist the backwash cycle
D. Lock
E. Bump
F. None of the above

188. Some filters can operate longer than one week before needing to be _____,
A. Bumped
B. Jetted
C. Air scoured
D. Backwashed
E. Flow restrictor
F. None of the Above

189. Long filter runs can cause the filter media to pack down so that it is difficult to _____ during the backwash.
A. Control headloss
B. Control floc(s)
C. Expand the bed
D. Backwash cycle
E. All of the Above
F. None of the Above

Backwashing Process
190. The normal method for opening the filter backwash valve involves draining the water level above the filter to a point six inches above the filter media.
A. True B. False

191. When the backwash valve is opened, backwash water is allowed to start flowing into the filter and start _____.
A. Control headloss
B. Crust on the filter
C. Expand the bed
D. Some means of controlling the media carryover
E. Carrying suspended material away from the filter
F. None of the Above

192. For a filter with an air wash, the filter backwash water and the air wash should not be used together**.** This would be possible only if _____ is installed.
A. Control headloss
B. Crust on the filter
C. Expand the bed
D. Some means of controlling the media carryover
E. Carrying suspended material away from the filter
F. None of the Above

193. When the surface wash is turned on it should be allowed to operate for several minutes to break up the _____,

A. Control headloss
B. Crust on the filter
C. Expand the bed
D. Some means of controlling the media carryover
E. Carrying suspended material away from the filter
F. None of the Above

194. The time elapsed from when the filter wash is started until full flow is applied to the filter should be greater than one minute.

A. True B. False

195. The filter expansion needed will depend on how much agitation is needed to suspend the filter media to?_____.

A. Control headloss
B. Crust on the filter
C. Expand the bed
D. Some means of controlling the media carryover
E. Remove the suspended material trapped in the filter
F. None of the Above

Disposal of Filter Backwash Water

196. Water from the filter backwash can be returned directly to the environment.

A. True B. False

197. The supernatant is then pumped back to the head of the treatment plant at a rate not exceeding ten percent of the_____.

A. Daily flow
B. Backwash water
C. Eliminates the need to obtain
D. Raw water flow entering the plant
E. Amount of solids that must be removed
F. None of the Above

198. The settled material is pumped to a sewer or is treated in the solids-handling process of the plant. This conserves most of the backwash water and _____ a pollution discharge permit for the disposal of the filter backwash water.

A. Daily flow
B. Backwash water
C. Eliminates the need to obtain
D. Raw water flow entering the plant
E. Amount of solids that must be removed
F. None of the Above

199. Since backwash is a very high flow operation, the surges that are created from the backwash coming from the filter_____.

A. Daily flow
B. Backwash water
C. Return
D. Raw water flow entering the plant
E. Must not be allowed to enter the head of the plant
F. None of the Above

200. The spent backwash water must be stored in storage tanks and returned slowly to the treatment process.

A. True B. False

Filter to Waste

201. When filtration is started after backwash, suspended material remains in the filter media until the turbidity in the effluent meets standards. Depending on the type of filter, this may last from 20-40 minutes.

A. True B. False

202. Wasting is needed as some _____following the backwash.
A. Daily flow
B. Backwash water
C. Return
D. Suspended material remains in the filter media
E. Filtration should always be started
F. None of the Above

203. Filtration _____ after a backwash to prevent breakthrough of suspended material.
A. Daily flow
B. Backwash water
C. Return
D. Suspended material
E. Should always be started slowly
F. None of the Above

Filter Aids

204. A normal dose of polymer for filter aiding will be less than 0.1 ppm, but the exact dose will be decided by the result of a jar test and by experimentation in the treatment plant.
A. True B. False

205. _____ have very high molecular weight and cause the floc to coagulate and flocculate quickly.
A. Filter medias
B. Sand
C. Filters
D. Filter aids
E. Floc
F. None of the Above

206. More frequent filter backwashing and _____ will be required to remove the floc that has penetrated deeply into the filter bed.
A. Filter backwashing
B. Backwash water leaving the filter
C. Raw water flow entering the plant
D. Use of large volumes of backwash water
E. Serious damage to the filter underdrain
F. None of the Above

207. A _____ is a material that adds strength to the floc and prevents its breakup.
A. Filter backwashing
B. Backwash water leaving the filter
C. Raw water flow entering the plant
D. Too much backwash water is used
E. Filter aid
F. None of the Above

208. _____ are water-soluble, organic compounds that can be purchased in either wet or dry form.
A. Filter medias
B. Activated Carbon
C. Filters
D. Polymers
E. Floc
F. None of the Above

209. When used as a filter aid, the _____ strengthens the bonds and prevents the shearing forces in the filter from breaking the floc apart.
A. Filter media
B. Lime
C. Filter
D. Polymer
E. Floc
F. None of the Above

Filter Operating Problems

210. There are three major types of filter problems. They can be caused by chemical treatment before the filter, _____, and backwashing of filters.

A. Filter aid
B. Control of filter flow rate
C. Filter media process
D. Turbidity breakthrough
E. Coagulation and flocculation stages
F. None of the above

Chemical Treatment before the Filter

211. The _____ of the water treatment must be monitored continuously.

A. Filter aid
B. Control of filter flow rate
C. Filter media process
D. Turbidity breakthrough
E. Coagulation and flocculation stages
F. None of the above

212. There may be a need for better mixing during the coagulation or the addition of more? _____.

A. Filter aid
B. Control of filter flow rate
C. Filter media process
D. Turbidity
E. Coagulation and flocculation
F. None of the above

213. If there is a rapid increase in filter head loss, too much coagulant may be clogging the filter.

A. True B. False

214. Adjustments in the amount of coagulant added must be made frequently to prevent the filter from becoming overloaded, with suspended material. This overload may cause the filter to prematurely reach its. _____.

A. Filter aid
B. Control of filter flow rate
C. Maximum headloss
D. Turbidity breakthrough
E. Coagulation and flocculation stages
F. None of the above

215. If there is early turbidity breakthrough in the filter effluent, more coagulant may have to be added to the coagulation process.

A. True B. False

Control of Filter Flow Rate

216. When a filter is subjected to rapid changes in flow rate, the turbidity of the effluent will not be affected; the dirtier the coagulation and flocculation stages, the greater the effect.

A. True B. False

217. The filters should be backwashed before putting them back into operation or operated to waste until the _____ meets the standards.

A. Basin water
B. Surge to the filter(s)
C. Filter media breakthrough
D. Turbidity
E. Effluent
F. None of the Above

218. Addition of filter aids may also reduce the impact on the filter effluent.

A. True B. False

219. Backwashing a filter temporarily takes it out of service, the remaining filter(s) must pick up the additional flow, this can cause a change in flow that will cause _____.
A. Turbidity breakthrough D. Filter aid breakthrough
B. Backwash storage basin E. Coagulation and flocculation stages
C. Filter media breakthrough F. None of the Above

220. If the plant has a _____, this will also prevent surges to the filters.
A. Turbidity breakthrough D. Filter aid breakthrough
B. Backwash storage basin E. Coagulation and flocculation stages
C. Filter media breakthrough F. None of the Above

221. If the plant is not operated continuously, the start-up at the beginning of the day will cause a _____.
A. Basin to catch the overflow D. Turbidity breakthrough
B. Surge to the filter(s) E. Effluent
C. Filter media breakthrough F. None of the Above

Hard Water Section
222. Water contains various amounts of_____, some of which impart a quality known as hardness.
A. Water hardness D. Calcium (Ca) and magnesium (Mg)
B. Carbonate hardness E. Dissolved minerals
C. The calcium-magnesium distinction F. None of the Above

Occurrence of Hard Water
223. Hard water is caused by soluble, divalent, _____, (positive ions having valence of 2). The principal chemicals that cause water hardness are calcium (Ca) and magnesium (Mg).
A. Water hardness D. Calcium (Ca) and magnesium (Mg)
B. Metallic cations E. Noncarbonate hardness
C. Carbon dioxide (CO_2) F. None of the Above

Membrane Filtration Processes
224. In particular, _____ enables some water systems having contaminated water sources to meet new, more stringent regulations.
A. Membrane technology D. Conventional thermal separation process(es)
B. Macromolecule(s) E. Direct filtration
C. Solute(s) F. None of the Above

Description of Membrane Filtration Processes
225. In the simplest _____, water is forced through a porous membrane under pressure, while suspended solid, large molecules, or ions are held back or rejected.
A. The recovery of organic vapor(s) D. A selective barrier
B. Fractional distillation E. Thermal separation method(s)
C. Membrane processes F. None of the Above

Microfiltration

226. The current primary use of MF is by industries to remove very fine particles from process water. In addition, the process has also been used as a pretreatment for.

A. Reverse osmosis or RO
B. Potable water treatment
C. Other membrane processes
D. Direct filtration process
E. Microfiltration or MF
F. None of the Above

227. The suggested use of microfiltration is to improve filtering efficiency, especially for small particles that could contain _____

A. Process liquid
B. Chloride and sodium
C. Total dissolved solids (TDS)
D. Material
E. Bacterial and protozoan life
F. None of the Above

Ultrafiltration

228. The smaller pore size is designed to remove colloids and substances that have larger molecules, which are called _____.

A. Reverse osmosis or RO
B. Potable water treatment
C. High-molecular-weight materials
D. Direct filtration process
E. Microfiltration or MF
F. None of the Above

229. UF membranes can be designed to pass material that weigh less than or _____.

A. Process liquid
B. Chloride and sodium
C. Total dissolved solids (TDS)
D. Material
E. Equal to a certain molecular weight
F. None of the Above

230. Although UF does not generally work well for removal of_____, it can be used effectively for removal or most organic chemicals.

A. Process liquid
B. Chloride and sodium
C. Total dissolved solids (TDS)
D. Material
E. Salt or dissolved solids
F. None of the Above

Nanofiltration

231. The Nanofiltration (NF) process has been used primarily for water softening and reduction of_____.

A. Process liquid
B. Chloride and sodium
C. Total dissolved solids (TDS)
D. Material
E. Bacterial and protozoan life
F. None of the Above

232. NF capability will undoubtedly increase the use of _____for potable water treatment.

A. Reverse osmosis or RO
B. Potable water treatment
C. NF
D. Direct filtration process
E. Microfiltration or MF
F. None of the Above

Reverse Osmosis

233. RO membranes have very low pore size that can reject ions at very high rates, including_____.

A. Process liquid
B. Chloride and sodium
C. Total dissolved solids (TDS)
D. Material
E. Bacterial and protozoan life
F. None of the Above

234. RO also works for most organic chemicals, ~~and~~ radionuclides and microorganisms. An important _____ is for industrial water uses such as semiconductor manufacturing.

A. RO process
B. Potable water treatment
C. Colloids and substances
D. Direct filtration process
E. Microfiltration or MF
F. None of the Above

Microfiltration Specific Process

235. Microfiltration is a type of physical filtration process where a contaminated fluid is passed through a special pore-sized membrane to separate microorganisms and suspended particles from?

A. Process liquid
B. Chloride and sodium
C. Total dissolved solids (TDS)
D. Material
E. Bacterial and protozoan life
F. None of the Above

236. Which of the following terms works with such as ultrafiltration and reverse osmosis to provide a product stream which is free of undesired contaminants?

A. Various other separation processes
B. MF membranes
C. Ultrafiltration and reverse osmosis
D. Batch or semi-continuous filtration
E. Retentate and product streams
F. None of the Above

237. Microfiltration usually serves as a pre-treatment for other separation processes such as?

A. Cross flow filtration
B. Filtration process(es)
C. Performance of microfiltration
D. Ultrafiltration
E. Microfiltration process
F. None of the Above

Reverse Osmosis Process Section

238. Generally, _____ result in higher osmotic pressures.

A. Pressure differential
B. Osmotic pressure
C. Higher molecular weights
D. Colloidal and suspended matter
E. Waste (concentrate)
F. None of the Above

239. Common tap water, as found in most areas, may have an osmotic pressure of about 10 PSI, or about~~?~~ _____.

A. 36,000 PPM
B. A pressure of 10 PSI
C. Osmotic pressure(s)
D. 1.68 Bar
E. 376 PSI
F. None of the Above

240. Osmosis is a natural phenomenon in which a liquid - water in this case - passes through a semi-permeable membrane from a relatively dilute solution toward a more concentrated solution. This flow produces a measurable pressure, called osmotic pressure.

A. True B. False

Brine Channel

241. Concentrated raw water is called the reject stream or concentrate stream**. I**t may also be called brine if it is coming from a _____.

A. Each sheet of membrane material
B. Microporous support layer
C. Salt water source
D. Amount of permeate or product water
E. Concentrations of TDS
F. None of the Above

242. The _____, when sufficient flows are maintained, serves to carry away the impurities removed by the membrane, thus keeping the membrane surface clean and functional.

A. Pressure differential
B. Osmotic pressure
C. Higher molecular weights
D. Concentrate
E. Waste (concentrate)
F. None of the Above

Ozone

243. This compound is obtained by passing a flow of air or oxygen between two electrodes that are subjected to an alternating current in the order of 10,000 to 20,000 volts.

A. Chloramine
B. Liquid Ozone
C. Ozone
D. Oxygen and nascent oxygen
E. O2
F. None of the Above

244. This compound is a light blue gas at room temperature.

A. Chloramine
B. Liquid Ozone
C. Ozone
D. Oxygen and nascent oxygen
E. O2
F. None of the Above

245. Ozone has a _____similar to that sometimes noticed during and after heavy electrical storms. In use, ozone breaks down into oxygen and nascent oxygen.

A. Self-policing pungent odor
B. THMs
C. Light blue gas
D. Oxygen and nascent oxygen
E. Strongest oxidizing agent
F. None of the Above

246. Ozone does not form chloramines or _____, and while it may destroy some THMs, it may produce others byproducts when followed by chlorination.

A. Carcinogens
B. THMs
C. Complete disinfectant
D. Oxygen and nascent oxygen
E. Flocculation and coagulation
F. None of the Above

247. Ozone falls into the same category as other disinfectants, because it can produce?

A. Carcinogens
B. THMs
C. DBPs
D. Oxygen and nascent oxygen
E. Strongest oxidizing agent
F. None of the Above

248. Which compound is very unstable and can readily explode, as a result, it is not shipped and must be manufactured on-site?

A. Chloramine
B. Liquid Ozone
C. Ozone
D. Oxygen and nascent oxygen
E. O2
F. None of the Above

249. It is the nascent oxygen that produces the high oxidation**,** disinfections, and even sterilization. Each water has its own_____, in the order of 0.5 ppm to 5.0 ppm. Contact time, temperature, and pH of the water are factors in determining the ozone demand.

A. Carcinogens
B. THMs
C. Ozone demand
D. Oxygen and nascent oxygen
E. Strongest oxidizing agent
F. None of the Above

Water Production Section - Groundwater and Wells

250. Toxic material spilled or dumped near a well can leach into the _____ and contaminate the groundwater drawn from that well.

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

251. _____ flows slowly through water-bearing formations (aquifers) at different rates.

A. Well
B. Drinking water
C. Water table
D. Soil moisture
E. Groundwater
F. None of the Above

252. Many terms are used to describe the nature and extent of the groundwater resource**.** The level below which all the spaces are filled with water is called the_____.

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

253. Above the water table lies the_____.

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

254. The entire region below the water table is called the saturated zone and water in this saturated zone is called_____.

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

255. _____are rocks in which the groundwater moves through cracks, joints, or fractures in otherwise solid rock.

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

256. Limestones are often _____,

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

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

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

259. A well in such an aquifer is called an artesian well.
A. True B. False

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

261. _____ such as sandstone may become so highly cemented or recrystalized that all of the original space is filled. In this case, the rock is no longer a porous medium.
A. Unconfined aquifer(s)
B. Groundwater
C. Porous media
D. Fractured aquifer(s)
E. Aquifer
F. None of the Above

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

263. _____ usually flows downhill with the slope of the water table.
A. Well
B. Drinking water
C. Water table
D. Soil moisture
E. Groundwater
F. None of the Above

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

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

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

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

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

269. _____ is the vertical drop in the height between the water level in the well prior to pumping and the water level in the well during pumping.
A. Water table
B. Groundwater
C. Drawdown
D. Cone of depression
E. Well
F. None of the Above

270. When a well is installed in _____, water moves from the aquifer into the well through small holes or slits in the well casing or, in some types of wells, through the open bottom of the well.
A. Confined aquifer
B. Aquifer(s)
C. Hydrologic cycle
D. Water table
E. An unconfined aquifer
F. None of the Above

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

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

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

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

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

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

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

Bacteriological Monitoring Section
278. _____ are usually harmless, occur in high densities in their natural environment**,** and are easily cultured in relatively simple bacteriological media.
A. Indicator bacteria
B. Bacteria tests
C. Contaminate
D. Microbiological analysis
E. Presence of an indicator
F. None of the Above

279. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and _____.
A. Sample container
B. Bacteria tests
C. Coliform bacteria
D. Escherichia coli (E. coli)
E. Iron bacteria
F. None of the Above

280. According to the text, the routine microbiological analysis of your water is for _____.
A. Indicator bacteria
B. Bacteria tests
C. Contamination
D. Coliform bacteria
E. Presence of an indicator
F. None of the Above

281. The _____ group is used as an indicator organism to determine the biological quality of your water.
A. Microbiological analysis
B. Bac-T
C. Coliform bacteria
D. Escherichia coli (E. coli)
E. Presence of an indicator
F. None of the Above

282. The presence of an indicator or _____ in your drinking water is an important health concern.
A. Indicator bacteria
B. Pathogenic bacteria
C. Contaminate
D. Microbiological analysis
E. Presence of an indicator
F. None of the Above

283. _____ signal possible fecal contamination, and therefore, the potential presence of pathogens.

A. Indicator bacteria
B. Pathogenic bacteria
C. Contaminate
D. Microbiological analysis
E. Presence of an indicator
F. None of the Above

Bacteria Sampling

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

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

285. Refrigerate the sample and transport it to the testing laboratory within eight hours. Many labs will accept bacteria samples on Friday. Mailing Indicator bacteria is not recommended because laboratory analysis results are not as reliable.

A. True B. False

286. _____ 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. Colonies
B. Algae
C. Coliform bacteria
D. Escherichia coli (E. coli)
E. Iron bacteria
F. None of the Above

287. _____ are common in the environment and are generally not harmful**.** However, the presence of these bacteria 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. Diseases
B. Germs
C. Coliform bacteria
D. Escherichia coli (E. coli)
E. Iron bacteria
F. None of the Above

Laboratory Procedures

288. The laboratory may perform the _____ in one of four methods approved by the U.S. EPA and your local environmental or health division.

A. Colilert
B. Coliform
C. Sample time
D. Total coliform analysis
E. Pathogen test
F. None of the Above

Methods

289. 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.

A. Colilert
B. Coliform
C. Sample stuff
D. Total coliform analysis
E. Pathogen media
F. None of the Above

290. If coliforms are present, the laboratory will analyze the sample further to determine if these are _____ or _____and report their presence or absence.

A. Colilert, E. coli
B. Coliforms, E. coli
C. Fecal coliforms, E. coli
D. Total coliform analysis, Pathogens
E. Pathogens, Total coliform analysis
F. None of the Above

Types of Water Samples

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

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

The three (3) types of samples are:

292. Repeat samples are samples collected following a 'coliform present' routine sample. The number of repeat samples to be collected is based on the number of _____ samples you normally collect.

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

293. What type of samples can be collected for other reasons? Examples would be a sample collected after repairs to the system.

A. Repeat
B. Special
C. Sample
D. Total coliform analysis
E. Routine
F. None of the Above

294. What type of samples can be collected on a routine basis to monitor for contamination? Collection should be in accordance with an approved sampling plan.

A. Repeat
B. Special
C. Sample
D. Total coliform analysis
E. Routine
F. None of the Above

Repeat Sampling

295. Whenever a _____ has total coliform or fecal coliform present, a set of repeat samples must be collected within 24 hours after being notified by the laboratory.

A. MCL compliance
B. Distribution system
C. Routine sample
D. Original sampling location
E. Repeat sample(s)
F. None of the Above

The follow-up for repeat sampling is:

296. If only one _____per month or quarter is required, four (4) repeat samples must be collected.

A. Special Sample
B. Routine sample
C. Repeat sample(s)
D. Coliform present
E. Original sampling location
F. None of the Above

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

A. Compliance sample
B. Distribution sample
C. Routine sample
D. QA/QC Split
E. Repeat sample(s)
F. None of the Above

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

A. MCL compliance
B. Distribution system
C. Routine sample
D. Original sampling location
E. Repeat sample(s)
F. None of the Above

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

A. Special Sample
B. Routine sample
C. Repeat sample(s)
D. Coliform present
E. Original sampling location
F. None of the Above

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

A. Special Sample
B. Routine sample
C. Repeat sample(s)
D. Coliform present
E. Original sampling location
F. None of the Above

301. Repeat samples must be collected from: All _____ are included in the MCL compliance calculation.

A. Special Sample
B. Routine sample
C. Repeat sample(s)
D. Coliform present
E. Original sampling location
F. None of the Above

Sampling Procedures

302. The _____ must be followed and all operating staff must be clear on how to follow the sampling plan.

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

303. Staff must be aware of how often sampling must be done, the _____to be used for collecting the samples, and the proper procedures for identification, storage and transport of the samples to an approved laboratory.

A. Multiple sources
B. Sample siting plan
C. Total coliform
D. Proper procedures and sampling containers
E. Sampling containers
F. None of the Above

304. In addition, proper procedures must be followed for repeat sampling whenever a routine sample result is_____ _____.

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

Maximum Contaminant Levels (MCLs)

305. State and federal laws establish standards for drinking water quality. Under normal circumstances when these standards are being met, the water is somewhat safe to drink with little threat to human health.

A True B. False

306. State and federal laws establish standards for drinking water quality known as maximum contaminant levels (MCL). When a particular contaminant exceeds its _____ a potential health threat may occur.

A. Coliform bacteria count
B. MCL
C. Standards
D. HPC
E. CFU
F. None of the Above

307. The _____ are based on extensive research on toxicological properties of the contaminants, risk assessments and factors, short-term (acute) exposure, and long-term (chronic) exposure.

A. Coliform bacteria
B. MCLs
C. Standards
D. HPC
E. CFU
F. None of the Above

308. There are two types of _____ for coliform bacteria.

A. Coliform bacteria
B. MCLs
C. Standards
D. MCL violations
E. CFU
F. None of the Above

309. The first _____ for coliform bacteria is for total coliform; the second is an acute risk to health violation characterized by the confirmed presence of fecal coliform or E. coli.

A. Coliform bacteria
B. MCLs
C. Standards
D. MCL violations
E. CFU
F. None of the Above

Positive or Coliform Present Results

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

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

311. The Drinking Water Program contracts with many of the local health departments to provide_____to water systems.

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

312. After you have contacted an agency for assistance, you will be instructed as to the proper repeat sampling procedures and possible corrective measures for solving the problem. It is very important to initiate the _____ as the corrective measures will be based on those results.

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

Heterotrophic Plate Count HPC

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

A. True B. False

314. Colonies may arise from pairs, chains, clusters, or single cells, all of which are included in the term_____.

A. Coliform bacteria units
B. MCLs units
C. Standards
D. HPC units
E. Colony-forming units
F. None of the Above

Spread Plate Method

315. All colonies are on the _____ where they can be distinguished readily from particles and bubbles.

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

316. During the Spread Plate Method, colonies can be transferred quickly, and _____ can be easily discerned and compared to published descriptions.

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

Membrane Filter Method

317. This method permits testing large volumes of _____ and is the method of choice for low-count waters.

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

Heterotrophic Plate Count (Spread Plate Method)

318. Heterotrophic organisms utilize organic compounds as their carbon source. In contrast, _____ use inorganic carbon sources.

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

319. The _____ provides a technique to quantify the bacteriological activity of a sample.

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

Total Coliforms

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

A. True B. False

321. For systems that collect fewer than _____ samples per month, no more than one sample per month may be positive. In other words, the second positive result (repeat or routine) in a month or quarter results in a MCL violation.

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

Acute Risk to Human Health Violations:

322. An acute violation for nitrate is a violation of the _____.

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

323. An _____ occurs if a routine analysis shows total coliform present and is followed by a repeat analysis which indicates fecal coliforms or E. coli present.

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

324. An acute violation is any outbreak of _____, as defined by the rules.

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

Protozoan Diseases

325. _____ are larger than bacteria and viruses but still microscopic**.** They invade and inhabit the gastrointestinal tract.

A. HIV infections
B. Symptoms
C. Giardiasis
D. Hepatitis A
E. Protozoan pathogens
F. None of the Above

326. Some of the parasites enter the environment in a dormant form, with a protective cell wall, called a_____.

A. Lamblia
B. Shell
C. Case
D. Cyst
E. Infection
F. None of the Above

Giardia lamblia

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

Cryptosporidiosis

328. The mode of transmission of this protozoan disease is fecal-oral, either by person-to-person or animal-to-person.

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

EPA Rules

Arsenic

329. Studies have linked long-term exposure of _____ in drinking water to a variety of cancers in humans.

A. Arsenic
B. Copper
C. Basalt
D. THHMMS
E. Silica
F. None of the Above

330. Back in October 2001, the EPA decided to move forward with implementing the 10ppb standard for _____ in drinking water.

A. Arsenic
B. Trihalomethanes
C. Disinfection
D. Copper
E. Disinfection byproducts (DBPs)
F. None of the Above

ICR

331. The EPA has collected data required by the Information Collection Rule (ICR) to support future regulation of microbial contaminants, disinfectants, and disinfection byproducts.

A. True B. False

332. The rule is intended to provide EPA with information on chemical byproducts that form when disinfectants used for microbial control react with chemicals already present in source water (disinfection byproducts (DBPs)); disease-causing microorganisms (pathogens), including Cryptosporidium; and engineering data to control these contaminants.

A. True B. False

More on the Current Stage 2 DBP Rule

333. _____ is one part of the Microbial and Disinfection Byproducts Rules (MDBPs), which are a set of interrelated regulations that address risks from microbial pathogens and disinfectants/disinfection byproducts.

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

334. The _____ focuses on public health protection by limiting exposure to DBPs, specifically total trihalomethanes (TTHM) and five haloacetic acids(HAA5).

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

335. This rule will apply to all community water systems and nontransient non-community water systems that add a primary or residual disinfectant other than _____or deliver water that has been disinfected by a primary or residual disinfectant other than UV.

A. Ultraviolet (UV) light
B. The open-channel system
C. UV rather than ozone
D. UV source
E. UV radiation
F. None of the Above

336. Which of the following rules has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water?

A. Stage 2 DBPR
B. DBP exposure
C. The Stage 2 DBP rule
D. Long Term 2 Enhanced Surface Water Treatment Rule
E. Safe Drinking Water Act (SDWA)
F. None of the Above

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

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

Microbial Regulations

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

A. True B. False

339. The _____ specifies treatment criteria to assure that these performance requirements are met; they include turbidity limits, disinfectant residual, and disinfectant contact time conditions.

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

340. The _____ was established in December 1998 to control Cryptosporidium, and to maintain control of pathogens while systems lower disinfection byproduct levels to comply with the Stage 1 Disinfectants/Disinfection Byproducts.

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

341. The EPA established a MCL of 0.0010 for all public water systems and a 99% removal requirement for Cryptosporidium in filtered public water systems that serve at least 100,000 people.
A. True B. False

Chlorine Section - Pathophysiology
342. The intermediate _____ of chlorine accounts for its effect on the upper airway and the lower respiratory tract.
A. Generation of free oxygen radicals
B. Vapor from Chlorine gas
C. Effects of Hydrochloric acid
D. Water solubility
E. The odor threshold for chlorine
F. None of the Above

343. Exposure to _____ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.
A. Hydrochloric acid
B. Chlorine gas
C. The gas
D. The chemical species produced
E. Plasma exudation
F. None of the Above

344. The odor threshold for chlorine is approximately_____.
A. 1 parts per million (ppm)
B. 3 parts per million (ppm)
C. 10 parts per million (ppm)
D. 3-5 parts per million (ppm)
E. 0.3-0.5 parts per million (ppm)
F. None of the Above

Early Response to Chlorine Gas
345. Chlorine gas, when mixed with ammonia, reacts to form_____. In the presence of water, chloramines decompose to ammonia and hypochlorous acid or hydrochloric acid.
A. Hypochlorous acid
B. Chlorine gas
C. Hydrochloric acid
D. Sulfuric acid
E. Chloramine gas
F. None of the Above

Immediate Effects
346. _____ toxicity include acute inflammation of the conjunctivae, nose, pharynx, larynx, trachea, and bronchi.
A. Hydrochloric acid
B. Chlorine gas
C. Hypochlorous gas
D. Sulfuric acid
E. HOCL
F. None of the Above

Chemistry of Chlorination
347. The hypochlorite ion is a much weaker disinfecting agent than hypochlorous acid, about 100 times less effective.
A. True B. False

348. pH and temperature affect the ratio of hypochlorous acid to hypochlorite ions. As the temperature is decreased, the _____increases.
A. Reduction Ratio
B. CT actual
C. Free chlorine residual
D. "CT" disinfection concept
E. Ratio of hypochlorous acid
F. None of the Above

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

350. Temperature plays a small part in the acid ratio. Although the ratio of _____is greater at lower temperatures, pathogenic organisms are actually harder to kill.
A. Hypochlorous acid D. Total chlorine
B. The amount of chlorine E. pH value and temperature
C. Chlorine Demand F. None of the Above

351. All other things being equal, _____ and a lower pH are more conducive to chlorine disinfection.
A. Lower pH D. Lower water temperature
B. Hypochlorous acid E. The hypochlorite ion
C. Higher water temperatures F. None of the Above

352. Under normal water conditions, hypochlorous acid will also chemically react and break down into a hypochlorite ion.
(OCl -): HOCl H^+ + OCl^- Also expressed HOCl → H^+ + OCl^-
(hypochlorous acid) (hydrogen) (hypochlorite ion)
A. True B. False

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

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

355. In water, there are always other substances (interfering agents) such as iron, manganese, turbidity, etc., which will combine chemically with the chlorine**.** This is called the _____.
A. Chlorine residual D. Break-point chlorination
B. Chlorine demand E. Total chlorine residual
C. Pathogen reduction F. None of the Above

356. Once chlorine molecules are combined with these interfering agents, they are not capable of disinfection. It is _____ that is much more effective as a disinfecting agent.
A. Chlorine residual D. Break-point chlorination
B. Chlorine demand E. Total chlorine residual
C. Free chlorine F. None of the Above

Methods of Control

357. The _____ shall be automatic proportional controlled, automatic residual controlled, or compound loop controlled.

A. Chlorine feed system
B. Constant flow rate(s)
C. Uninterrupted chlorination
D. Automatic proportional controlled
E. Constant pre-established dosage
F. None of the Above

358. In the _____ system, the equipment adjusts the chlorine feed rate automatically in accordance with the flow changes to provide a constant pre-established dosage for all rates of flow~~?~~.

A. Manual chlorine feed systems
B. Constant flow rate(s)
C. Uninterrupted chlorination
D. Automatic proportional controlled
E. Constant pre-established dosage
F. None of the Above

359. In the _____, the feed rate of the chlorinator is controlled by a flow proportional signal and a residual analyzer signal to maintain particular chlorine residual in the water.

A. Gas vacuum line
B. Compound loop control system
C. Manual chlorine feed systems
D. Mechanical gas proportioning equipment
E. After post chlorination
F. None of the Above

Pump, Motor and Hydraulic Section - Common Hydraulic Terms

360. The engineering science pertaining to liquid pressure and flow is called_____.

A. Pressure, Absolute
B. Pressure
C. Hydraulics
D. Hydrokinetics
E. Pascal's Law
F. None of the Above

361. The engineering science pertaining to the energy of liquid flow and pressure is called_____.

A. Pressure, Absolute
B. Pressure
C. Hydraulics
D. Hydrokinetics
E. Pascal's Law
F. None of the Above

362. The pressure applied to a confined fluid at rest is transmitted with equal intensity throughout the fluid is _____.

A. Pressure, Absolute
B. Pressure
C. Hydraulics
D. Hydrokinetics
E. Pascal's Law
F. None of the Above

363. The application of continuous force by one body upon another that it is touching; compression is the definition of_____.

A. Pressure, Absolute
B. Pressure
C. Hydraulics
D. Hydrokinetics
E. Pascal's Law
F. None of the Above

364. The head required to overcome the friction at the interior surface of a conductor and between fluid particles in motion is the definition of _____.

A. Head, Friction
B. Head, static
C. Head
D. Hydraulics
E. Hydrokinetics
F. None of the Above

365. The pressure in a fluid at rest is the definition of _____.
A. Pressure, Atmospheric
B. Pressure, Static
C. Hydraulics
D. Pressure, Gauge
E. Pascal's Law
F. None of the Above

366. The height of a column or body of fluid above a given point is the definition of _____.
A. Head, Friction
B. Head, static
C. Head
D. Hydraulics
E. Hydrokinetics
F. None of the Above

367. The pressure exported by the atmosphere at any specific location is the definition of
A. Pressure, Atmospheric
B. Pressure, Static
C. Hydraulics
D. Pressure, Gauge
E. Pascal's Law
F. None of the Above

General Pumping Fundamentals

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

369. Suction lift is when the level of water to be pumped is below the _____.
A. Impeller
B. Suction
C. Lift water
D. Centerline of the pump
E. Bellows
F. None of the Above

370. The ability of the pump to lift water is the result of a partial vacuum created at the _____.
A. Partial vacuum
B. Suction lift
C. Center of the pump
D. Pressure differential
E. Negative suction head
F. None of the Above

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

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

Pumps

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

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

375. Positive displacement pumps have a piston (or equivalent) moving in a closely-fitting cylinder, and forces are exerted on the fluid by motion of the piston.
A. True B. False

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

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

378. The force pump has _____ in the cylinder, one for supply and the other for delivery.
A. Two check valves
B. Diaphragms
C. Rotors
D. Cylinders
E. Lift pumps
F. None of the Above

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

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

381. The delivery in this case is from the upper part of the_____, which the piston does not enter.
A. Rotor
B. Force pump
C. Volume decreases
D. Air space
E. Cylinder
F. None of the Above

382. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston.
A. True B. False

383. The _____ may be moved mechanically, or by the pressure of the fluid on one side of the diaphragm.
A. Piston
B. Diaphragm
C. Discharged fluid
D. Cylinder
E. Lift pumps
F. None of the Above

384. Which type of pumps are typically used for water?
A. Bellows
B. Force pumps
C. Volume pumps
D. Force and lift pumps
E. Delivery pumps
F. None of the Above

Pump Categories

385. The purpose of a pump is to move water and generate the _____ we call pressure.
A. Centrifugal pump(s)
B. Impeller blade(s)
C. Delivery force
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

386. Sometimes, pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called? _____.
A. Inward force
B. Head
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

387. Pumps may be classified on the basis of the application they serve.
A. True B. False

388. All pumps may be divided into two major categories: (1) dynamic and (2) _____
A. Centrifugal
B. Impeller
C. Displacement
D. Diaphragm
E. Rotary
F. None of the Above

Basic Water Pump

389. Centrifugal pumps work by spinning water around in a circle inside a _____.
A. Vortex
B. Cylinder
C. Viscous drag pump
D. Center of the impeller
E. Cylindrical pump housing
F. None of the Above

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

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

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

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

Types of Water Pumps

394. Impellers are rotated by the pump motor, which provides the _____ needed to overcome the pumping head.

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

395. The size and number of stages, horsepower of the motor and _____are the key components relating to the pump's lifting capacity.

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

396. _____are variable displacement pumps that are by far used the most.

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

397. The turbine pump utilizes impellers enclosed in single or multiple bowls or stages to~~?~~ _____ by centrifugal force.

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

Backflow

398. Backflow is the undesirable reversal of flow of nonpotable water or other substances through a _____and into the piping of a public water system or consumer's potable water system.

A. Backflow
B. Backpressure
C. Backsiphonage
D. Cross-connection
E. Indirect connection
F. None of the Above

399. _____ can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main, etc.

A. Backflow
B. Backpressure
C. Backsiphonage
D. Cross-connection
E. Indirect connection
F. None of the Above

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

A. Backflow
B. Backpressure
C. Backsiphonage
D. Cross-connection
E. Indirect connection
F. None of the Above