

Registration form

**WATER TREATMENT 202 \$150.00
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List number of hours worked on assignment must match State Requirement. _____

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

Water Treatment ___ Water Distribution ___ Other _____

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WT 202 Answer Key

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

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

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If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00.

This course contains general EPA's SDWA federal rule requirements. Please be aware that each state implements water / sampling procedures/safety/ environmental / 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 not be in non-compliance and do not follow this course for proper compliance.

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

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Any other concerns or comments.

Water Treatment 202 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.**

Microbial Regulations

1. One of the key regulations developed and implemented by the United States Environmental Protection Agency to counter pathogens in drinking water is the Surface Water Treatment Rule requires that a public water system, using 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
2. 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. The new rule will tighten turbidity standards by December 2001.
A. True B. False
3. Color is an indicator of the physical removal of particulates, including pathogens.
A. True B. False

Water Quality Key Words

4. Which of the following substances or compounds is manufactured from aluminum hydroxide by dehydroxylating it in a way that produces a highly porous material?
A. Activated alumina D. Dissolved organic carbon
B. Fluoride E. Aluminum salts
C. Activated carbon F. None of the Above
5. Which of the following substances or compounds has been processed to make it extremely porous and thus to have a very large surface area available for adsorption or chemical reactions?
A. Activated alumina D. Dissolved organic carbon
B. Fluoride E. Aluminum salts
C. Activated carbon F. None of the Above

6. Which of the following substances or compounds has a high degree of microporosity; just one gram has a surface area of approximately 500 m², as determined typically by nitrogen gas adsorption?

- A. Activated alumina
- B. Fluoride
- C. Activated carbon
- D. Dissolved organic carbon
- E. Aluminum salts
- F. None of the Above

7. Which of the following substances or compounds is a broad classification for organic molecules of varied origin and composition within aquatic systems.

- A. Activated alumina
- B. Fluoride
- C. Activated carbon
- D. Dissolved organic carbon
- E. Aluminum salts
- F. None of the Above

8. The "dissolved" fraction of which compound is an operational classification.

- A. Activated alumina
- B. Fluoride
- C. Activated carbon
- D. Organic carbon
- E. Aluminum salts
- F. None of the Above

9. EDTA is a widely used abbreviation for the chemical compound Electrodeialysis acid.

- A. True B. False

10. Which of the following substances or compounds forms especially strong complexes with Mn(II), Cu(II), Fe(III), Pb (II) and Co(III)?

- A. Activated alumina
- B. Dissolved organic carbon
- C. Activated carbon
- D. Ethylenediaminetetraacetic acid (EDTA)
- E. B and C
- F. None of the Above

Water Treatment Introduction

Preliminary Treatment

11. Weeds, leaves, and trash, if not removed, these 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

12. According to the text, wire mesh screens need maintenance and will require?

- A. Manual cleaning
- B. Automatic cleaning
- C. No cleaning
- D. Replacement
- E. A and B
- F. None of the Above

13. 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

Pre-Sedimentation

14. 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
- B. Coagulation
- C. Purification
- D. Flocculation
- E. Sedimentation basin(s)
- F. None of the Above

15. Which of the following treatment terms is used after the flocculation process?

- A. Filtration
- B. Coagulation
- C. Purification
- D. Flocculation
- E. Sedimentation basin(s)
- F. None of the Above

16. Scrapers on the bottom move the settled sludge to one or more hoppers at the influent end of the tank; it may have a _____ or traveling bridge used to collect the sludge.

- A. Screw conveyor
- B. Conveyor belts
- C. Dissolved air floatation
- D. Manual skimmers
- E. Turnstile
- F. None of the Above

17. Most clarifiers will have baffles to prevent backflow from entering the effluent.

- A. True
- B. False

Flights and Chains

18. Flights and chains remove the scum from the _____ of the basin.

- A. Supernatant
- B. Surface
- C. Scum box
- D. Armature
- E. A and B
- F. None of the Above

19. 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

20. To prevent damage to the flights and chains due to overloads, a _____ is used.

- A. Bearing
- B. Reducer
- C. Shear pin
- D. Safety net
- E. A and B
- F. None of the Above

Circular Clarifiers

21. The most common type of Circular Clarifier has a center pier or column.

- A. True
- B. False

22. Which of the following systems use graded silica Sand filter media?

- A. Conventional technology
- B. Reconditioning cycle
- C. Membranes
- D. All of the above except C
- E. Chemical pretreatment
- F. None of the Above

23. Filtration occurs only within the last few inches of the courser materials at the bottom of the bed.

- A. True
- B. False

24. The media becomes progressively finer and denser in the lower layers.

- A. True
- B. False

25. As suspended particles accumulate in a filter bed, the pressure drop through the filter increases.

- A. True
- B. False

26. 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.
A. True B. False
27. Which of the following processes uses Alum and cationic polymer to neutralize the charge?
A. Filtration D. Flocculation
B. Reconditioning E. Conventional
C. Purification F. None of the Above
28. Which of the following compounds combines with alkalinity in the raw 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
29. Which of the following systems 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
30. Which of the following systems 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
31. Which of the following terms 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
32. Which of the following terms 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
33. 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
34. Which of the following terms 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
35. 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

36. The primary difference between Direct Filtration Plant vs. 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

37. Which of the following terms 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
38. 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

39. 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
40. 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
41. 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
42. Aluminum Sulfate is also excellent for removing nutrients such as phosphorous in wastewater treatment.
- A. True
 - B. False
43. Fine particles must be coagulated, or "stuck together" to form larger particles, which can be filtered, this is achieved through the use of?
- A. Sedimentation
 - B. Coagulation
 - C. Coagulant chemicals
 - D. Flocculation
 - E. All of the Above
 - F. None of the Above
44. Which of the following terms are required since colloidal particles by themselves have the tendency to stay suspended in water and not settle out?
- A. Cationic polymers
 - B. Coagulation
 - C. Coagulant chemicals
 - D. Flocculation
 - E. All of the Above
 - F. None of the Above

45. Which of the following terms are so small, their charge per volume is significant?
 A. Cationic polymers D. Aluminum Sulfate molecules
 B. Colloidal particles E. All of the Above
 C. Coagulant chemicals F. None of the Above
46. Coagulation is necessary to meet the current regulations for almost all potable water plants using surface water.
 A. True B. False
47. Coagulant chemicals such as "alum" work by neutralizing the negative charge, which allows the particles to come together.
 A. True B. False
48. 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
49. 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
50. According to the text, more than 98% of poliovirus type 1 was removed by conventional _____ and filtration.
 A. Cationic polymers D. Coagulation
 B. Coagulation helpers E. All of the Above
 C. Salts F. None of the Above
51. Which of the following terms 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
52. 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
53. Which of the following terms 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

Flocculation

54. 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

55. Flocculation is the process where 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

56. 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

57. Inside the contact chambers, water is slowly mixed allowing the coagulated particles, this is called "floc," and the particles become larger and stronger.

- A. True
- B. False

58. Which of the following process statements happens 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

Pre-Sedimentation

59. According to the text, depending on the quality of the source water, some plants have pre-sedimentation, this 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

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

- A. True
- B. False

61. Which of the following statements before sedimentation in which the velocity of the water is decreased so that the suspended material, including flocculated particles, can settle out by gravity?

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

62. Which of the following statements is later removed from the bottom of the basin?

- A. Equalize the basin
- B. Agitate the water
- C. Floc particles mix
- D. Particles combine to form a sludge
- E. Particles time to settle
- F. None of the Above

Filtration

63. Filtration is a water treatment process step used to remove turbidity, dissolved organics, odor, taste and color.

- A. True
- B. False

64. According to the text, the filter is periodically cleaned by a reversal of flow and the _____ into a drain.

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. Discharge of back-flushed water
- F. None of the Above

65. Which of the following terms are made of fabric, paper, or plastic?

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite filters
- D. Rapid-sand filters
- E. Granular synthetic filters
- F. None of the Above

66. Which of the following terms will also remove turbidity, but would not be recommended for that purpose only?

- A. Activated carbon filters
- B. Cartridge filters
- C. Anthracite coal
- D. Rapid-sand filters
- E. Granular synthetic material
- F. None of the Above

67. According to the text, water is filtered 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

68. Which of the following statements should be conducted on a routine basis, at least once per day?

- A. Wall scum
- B. Gate position
- C. Effluent control measurement
- D. Post-disinfection
- E. Filtration process performance
- F. None of the Above

69. Good chemical treatment management can often result in either early turbidity breakthrough or rapid head loss buildup.

- A. True
- B. False

70. 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

71. 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

72. Detention time is 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

73. Chlorine kills or inactivates harmful microorganisms.

- A. True
- B. False

74. 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

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

pH

76. According to the text, 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

77. According to the text, which of the following 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

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

- A. True
- B. False

Polymer

79. 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

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

- A. True
- B. False

Pre-Chlorination

81. Before the filtration process, chlorination will help: control fish and vegetation.

- A. True
- B. False

Hydrofluosilicic Acid

82. H_2SiF_6 a clear _____, with a pH ranging from 1 to 1.5 and 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

83. The pH of the water is adjusted with?

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

84. Which of the following terms 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

85. Which of the following terms 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

86. Water quality testing needs to be conducted throughout the water treatment process.

- A. True
- B. False

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

- A. True
- B. False

88. 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

89. To improve the subsequent treatment processes, chemicals are added to the water, and may include pH adjusters and coagulants.

- A. True
- B. False

90. Alum is a coagulant chemical, that neutralizes 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

91. 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

92. 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

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

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

94. The slope of the tube settlers 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

95. 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

96. Which of the following terms happened before the sedimentation step that is followed by filtration through mixed media?

- A. Tube settlers
- B. Reconditioning cycle
- C. Traditional sand filter
- D. Coagulation
- E. Chemical pretreatment
- F. None of the Above

Adsorption Clarifiers

97. In the 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

98. Water scouring cleans adsorption clarifiers followed by air flushing is a must.

- A. True
- B. False

99. Cleaning of the clarifier is initiated less often than filter backwashing because the clarifier removes less solids.

- A. True
- B. False

100. Tube-settler type of package plant, the sedimentation/clarification process is followed by mixed-media filtration and disinfection to complete the water treatment.

- A. True
- B. False

Clearwell

101. The clearwell provides temporary storage for the treated water, which is the final step in the conventional filtration process.

- A. True
- B. False

Turbidity

102. Which of the following statements 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

103. According to the text, 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

Disinfection Benchmarking

104. Public water systems will be required to develop a(n) _____ unless they perform applicability monitoring which demonstrates their disinfection byproduct levels are less than 80% of the maximum contaminant levels.

- A. Updated watershed control
- B. Direct filtration system
- C. Disinfection profile
- D. Disinfection benchmark
- E. A and D
- F. None of the Above

105. According to the text, if a system considers making a significant change to their disinfection practice they must develop a(n) _____ and receive State approval for implementing the change.

- A. Updated watershed control
- B. Direct filtration systems
- C. Disinfection profile
- D. Disinfection benchmark
- E. A and D
- F. None of the Above

Other Requirements

106. Finished water reservoirs for which construction begins after the effective date of the rule must be covered; and unfiltered systems must comply with _____ requirements that add Cryptosporidium as a pathogen of concern.

- A. Updated watershed control
- B. Direct filtration system
- C. Disinfection profiling
- D. Disinfection benchmarking
- E. A and D
- F. None of the Above

The Filtration Process

107. 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

108. 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

109. 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

110. Which of the following traps suspended material between the grains of filter media?

- A. Coagulation and flocculation
- B. Coagulation or oxidation processes
- C. Filtration process can be compared to a sieve or microstrainer
- D. Physical and chemical mechanisms
- E. Treatment process
- F. None of the Above

111. Which of the following statements will easily pass through the spaces between the grains of the filter media, making 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

112. 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

113. 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 in _____.

- 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

114. Which of the following statements will happen especially if coagulation and flocculation of the water before filtration was not properly controlled?

- A. 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

115. The oldest water filters developed were the slow sand filters, these have filter rates of around 0.05 gpm/ft² of surface area. This type of filter requires large filter areas.

- A. True B. False

116. 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

117. 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

118. Rapid sand filters can accommodate filter rates 40 times more than?

- A. Fixed film D. Activated carbon beds
B. Slow sand filters E. Without sand
C. Mixed media F. None of the Above

119. 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

120. The filter sand used in rapid sand filters is normal play sand for the purpose of water filtration.

- A. True B. False

121. 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

122. 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

123. Which of the following will 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

124. According to the text, the coarser sand in the _____ has larger voids that do not fill as easily.

- A. Rapid filters
- B. Slow rate filtration
- C. Backwash trough
- D. Sedimentation basin
- E. Mixed media
- F. None of the Above

False floor

125. 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
- B. Slow rate filtration system
- C. Backwash system
- D. Filter underdrain
- E. Leopold system
- F. None of the Above

Filtration Processes

126. The traditional design for many years is conventional filtration, this method provides effective treatment for just about any range of?

- A. Raw-water turbidity
- B. Costs
- C. Microorganisms
- D. Increase plant capacity
- E. All of the Above
- F. None of the above

127. Conventional filtration success is due partially to the sedimentation that precedes filtration and follows the coagulation and flocculation steps.

- A. True
- B. False

128. Many treatment plants have converted rapid sand filters in to multi-media filters in an attempt to?

- A. Control raw-water turbidity
- B. Lower capital cost
- C. Kill microorganisms
- D. Increase plant capacity
- E. All of the Above
- F. None of the Above

129. In the other type of filtration process, "direct filtration" no sedimentation follows the coagulation phase.

- A. True
- B. False

130. Which of the following water treatment terms is designed to filter water with an average turbidity of less than 25 NTU?

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

131. According to the text, dual and multi-media filters are used with Conventional Filtration.

- A. True
- B. False

132. Some of the benefits of _____ is that it has a lower capital cost, but this method or process cannot handle large variations in 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, sand, anthracite coal, and garnet.

- A. True
- B. False

135. In the design of 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

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

- A. True
- B. False

Pressure Sand Filters

137. Filtration rates are twice as good as gravity filters.

- A. True
- B. False

138. Which type of filter is used extensively in iron and manganese Removal plants?

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

139. Which of the following terms or methods cracking of the filter bed can occur quite easily, 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

140. Which of the following filtration terms is contained under pressure in a steel tank?

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

141. Which of the following filtration terms is the media 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

142. During filtration, the water is under pressure, but _____ will not occur in the filter.

- A. Gravity
- B. Velocity
- C. Air binding
- D. Flow
- E. Heat
- F. None of the Above

143. Which of the following terms or methods 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

144. According to the text, which of the following terms or methods have limitations, and 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

145. 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

146. Which of the following terms 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

147. Which of the following terms 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

Declining Rate

148. According to the text, which of the following terms or methods 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

149. 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

150. According to the text, which of the following terms or methods allows the filter head to increase until the filter becomes plugged with particles and the Head 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

151. Which of the following terms 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

152. Which of the following terms 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

153. Which of the following terms is measured in the difference 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

In-line Turbidimeter

154. 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

Filtration Process

155. 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

156. Water from the source or, more commonly, 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

157. When the filtration is started after being backwashed, there will be great head loss.

- A. True
- B. False

158. Which of the following terms in water is restricted during this time in filters with a control valve installed on the filter effluent pipe?

- A. Shelter bacteria
- B. Suspended material
- C. Turbidity
- D. Filter flow
- E. All of the above except D
- F. None of the Above

159. The control valve prevents filter surges, which could disturb the media and force _____ through the filter.

- A. Flow
- B. Suspended material
- C. Dissolved solids
- D. Floc
- E. Breakthrough
- F. None of the Above

160. Which of the following terms in water rate on a filter depends on the type of filter?

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

161. Which of the following terms 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

162. As the filter becomes dirty, 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

163. Which of the following terms 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

164. 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

165. Which of the following terms 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

166. The filter eventually fills with suspended material, 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

167. A normal backwash rate is between 1.2 to 1.5 gpm per square foot of filter surface area.

- A. True
- B. False

168. Proper backwashing is a very important step in the operation of a filter.

- A. True B. False

169. The filter will eventually develop additional operational problems, if the filter is not _____ completely,

- A. Bumped D. Backwashed
B. Jetted E. Flow restrictor
C. Air scoured F. None of the Above

170. The filter must be cleaned before the next filter run, treated water from storage is used for the backwash cycle.

- A. True B. False

171. Which of the following terms 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

172. Filter 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

173. The filter media needs to be agitated by the filter backwash to expand and agitate 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

174. Which of the following filter terms if 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

175. During filter backwash, the media expands upwards and around the washing arms.

- A. True B. False

176. According to the text, 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

177. Which of the following terms needs 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 washing
C. Air scour F. None of the Above

178. Which of the following terms is so high that the filter will no longer produce water at the desired rate?

- A. Headloss
- B. Floc(s)
- C. Flow restricting
- D. Backwash rate
- E. Flow rate
- F. None of the Above

179. Which of the following terms starts to break through the filter and the turbidity in the filter effluent increases; and/or a filter run reaches a given hour of operation?

- A. Headloss
- B. Floc(s)
- C. Flow
- D. Backwash rate
- E. Media
- F. None of the Above

180. If a filter is taken out of service for some reason, it does not need to be backwashed prior to being put on line.

- A. True
- B. False

181. 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

182. Filter effluent turbidity alone can cause high head loss and decreased filter flow rate, causing 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

183. According to the text, many 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

184. 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

185. 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

186. When the backwash valve is opened, this action allows backwash water 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

187. For a filter with an air wash, the filter backwash water and the air wash should not be used together, this could be possible only if the following 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

188. When the surface wash is turned on it should be allowed to operate for several minutes to break up?

- 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

189. 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

190. 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 to suspended material trapped in the filter
- F. None of the Above

191. According to the text, with a multi-media filter, the rate must be high enough to scrub the interface between the coal and the sand, where the highest amount of suspended solids will be removed from the media.

- A. True
- B. False

Disposal of Filter Backwash Water

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

- A. True
- B. False

193. 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

194. The settled material is pumped to a sewer or is treated in the solids-handling process, this conserves most of the backwash water and _____ a pollution discharge permit.

- 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

195. 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

196. According to the text, the spent backwash water must be stored in storage tanks and returned slowly to the treatment process.

A. True B. False

Filter to Waste

197. 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

198. According to the text, wasting is needed as some _____ following the backwash.

A. Daily flow D. Suspended material remains in the filter media
B. Backwash water E. Filtration should always be started
C. Return F. None of the Above

199. Which of the following terms should be done slowly after a backwash to prevent breakthrough of suspended material?

A. Daily flow D. Suspended material
B. Backwash water E. Filtration should always be started
C. Return F. None of the Above

Filter Aids

200. 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

201. Which of the following terms have very high molecular weight and cause the floc to coagulate and flocculate quickly?

A. Filter medias D. Filter aids
B. Sand E. Floc
C. Filters F. None of the Above

202. Which of the following terms reflects filter use of large volumes of backwash water to be able to remove the floc that has penetrated deeply into the filter bed.

A. Filter backwashing D. Too much backwash water is used
B. Backwash water leaving the filter E. Serious damage to the filter underdrain
C. Raw water flow entering the plant F. None of the Above

203. Which of the following terms reflects a material that adds strength to the floc and prevents its breakup?

A. Filter backwashing D. Too much backwash water is used
B. Backwash water leaving the filter E. Filter aid
C. Raw water flow entering the plant F. None of the Above

204. Which of the following terms are water-soluble, organic compounds that can be purchased in either wet or dry form?

A. Filter medias D. Filter aids
B. Activated Carbon E. Floc
C. Filters F. None of the Above

205. Which of the following terms expresses that the polymer strengthens the bonds and prevents the shearing forces in the filter from breaking the floc apart when used?

- A. Filter media
- B. Lime
- C. Filter
- D. Filter aid
- E. Floc
- F. None of the Above

206. Which of the following terms should be added just ahead of the filter?

- A. Filter media
- B. Polymer
- C. Filter
- D. Filter aid
- E. Floc
- F. None of the Above

207. Which of the following terms if too much is added will cause the bonds to become too strong, which may then cause the filter to plug?

- A. Filter media
- B. Polymer
- C. Filter
- D. Filter aid
- E. Floc
- F. None of the Above

Filter Operating Problems

208. According to the text, 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

209. Which of the following terms 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

210. Adjustments in the amount of coagulant added must be made frequently to prevent the filter from becoming overloaded, this 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

Control of Filter Flow Rate

211. 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

212. According to the text, addition of filter aids may also reduce the impact on the filter effluent.

- A. True
- B. False

213. When backwashing a filter and therefore temporarily taking 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
- B. Backwash storage basin
- C. Filter media breakthrough
- D. Filter aid breakthrough
- E. Coagulation and flocculation stages
- F. None of the Above

214. If the plant has a _____, this will also prevent surges to the filters.

- A. Turbidity breakthrough
- B. Backwash storage basin
- C. Filter media breakthrough
- D. Filter aid breakthrough
- E. Coagulation and flocculation stages
- F. None of the Above

215. If the plant is not operated continuously, and the start-up at the beginning of the day will cause a?

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

216. 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

Bacteriological Monitoring Section

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

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

218. 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

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

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

Bacteria Sampling

220. Water samples for this process 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

Laboratory Procedures

221. 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

222. 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

Types of Water Samples

223. 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:

224. 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

Repeat Sampling

225. Which of the following terms is 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

Sampling Procedures

226. This 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

Maximum Contaminant Levels (MCLs)

227. EPA had developed standards that are known as maximum contaminant levels (MCL). When a particular contaminant exceeds this term a potential health threat may occur.

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

Chain of Custody Procedures

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

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Samples transfer possession
- E. Sampling containers
- F. None of the Above

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

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

Positive or Coliform Present Results

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

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

231. Ideally speaking, your Drinking Water Program Agency should contract with health departments to provide _____ to water systems.

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

232. Hopefully 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

233. 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

Heterotrophic Plate Count (Spread Plate Method)

234. Which of the following terms use inorganic carbon sources, this is in contrast to Heterotrophic organisms utilize organic compounds as their carbon source?

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

235. Which of the following terms 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

236. 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

237. 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 Health (Fecal coliforms and E. coli)

238. A(n) _____ to human health violation occurs if either one of the following happens:

- A. Routine analysis
- B. Drinking violation
- C. Acute risk
- D. Human health violation
- E. Fecal coliform or E. coli is present
- F. None of the Above

The following are acute violations:

239. Which is violation of nitrate?

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

Pathogen Section

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

- A. Limits the treatment process
- B. Are mild in nature
- C. Cause intestinal illness
- D. Will cause fatalities
- E. Limit the travel of pathogens
- F. None of the Above

How Diseases are Transmitted.

241. Waterborne pathogens are primarily spread by the?

- A. Fecal-oral, or feces-to-mouth, route
- B. Dermal to fecal route
- C. Oral to fecal route
- D. Influenza route
- E. Waterborne mishaps
- F. None of the Above

Protozoan Caused Diseases

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

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

243. A few of the parasites enter the environment in a dormant form, with a protective cell wall, called a?

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

244. Which of the following terms can survive in the environment for long periods of time and is extremely resistant to conventional disinfectants such as chlorine?

- A. HIV
- B. Symptoms
- C. Infection
- D. Hepatitis A cyst
- E. Cyst
- F. None of the Above

Giardia lamblia

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

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

Cryptosporidiosis

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

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

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

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

Chlorine Gas

Pathophysiology

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

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

249. According to the text, respiratory exposure to _____ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.

- A. Hydrochloric acid
- B. Chlorine gas
- C. The gas
- D. The chemical species produced
- E. Plasma exudation
- F. None of the Above

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

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

Mechanism of Activity

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

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

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

- A. True
- B. False

Solubility Effects

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

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

Early Response to Chlorine Gas

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

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

255. The early response to the odor threshold for chlorine depends on the (1) concentration of chlorine gas, (2) duration of exposure, (3) water content of the tissues exposed, and (4) individual susceptibility.

- A. True
- B. False

Immediate Effects

256. Which of the following answers is the best choice for the immediate effects of this substance's 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

Pathological Findings

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

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

Chemistry of Chlorination

258. 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
- B. The amount of chlorine
- C. Chlorine Demand
- D. Total chlorine
- E. pH value and temperature
- F. None of the Above

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

- A. Lower pH
- B. Hypochlorous acid
- C. Higher water temperatures
- D. Lower water temperature
- E. The hypochlorite ion
- F. None of the Above

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

- A. True
- B. False

Types of Residual

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

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine
- D. Break-point chlorination
- E. Total chlorine
- F. None of the Above

Chlorine (DDBP)

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

- A. Free available chlorine and Total
- B. Free and Residual
- C. Break point and Free
- D. Free available chlorine and Combined Chlorine
- E. Combined chlorine and Readily available
- F. None of the Above

263. Chloramines are formed by reactions with?

- A. Acid and Cl_2
- B. Ammonia and Cl_2
- C. THMS and Cl_2
- D. Folic Acid and Cl_2
- E. THMs and Haploidic acid
- F. None of the Above

Chlorine Exposure Limits

264. OSHA PEL?

- A. 10 PPM
- B. 1 PPM
- C. 00.1 PPM
- D. 1,000 PPM
- E. 100 PPM
- F. None of the Above

265. Physical and chemical properties: A yellowish green, nonflammable and liquefied gas with an unpleasant and irritating smell.

- A. Cl_3
- B. Chlorine
- C. HOCl and OCl^-
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

266. Solid chlorine is about _____ times heavier than water and gaseous chlorine is about 2.5 times heavier than air.

- A. 1.5
- B. 1.0
- C. 0.5
- D. 2.5
- E. 3.0
- F. None of the Above

Pump, Motor and Hydraulic Section

Common Hydraulic Terms

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

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

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

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

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

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Hydraulics
- D. Pressure, Gauge
- E. Pascal's Law
- F. None of the Above

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

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

271. Which of the following definitions is often used to indicate gauge pressure?

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

272. Which of the following definitions is when the pressure is equal to the height times the density of the liquid?

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

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

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

274. Which of the following definitions varies with flow, size, type, and conditions of conductors and fittings, and the fluid characteristics?

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

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

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Hydraulics
- D. Pressure, Gauge
- E. Pascal's Law
- F. None of the Above

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

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

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

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Hydraulics
- D. Pressure, Gauge
- E. Pascal's Law
- F. None of the Above

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

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

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

- A. True
- B. False

General Pumping Fundamentals

280. 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

281. According to the text, 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

282. According to the text, the ability of the pump to lift water is the result of a partial vacuum created at the?

- A. Partial vacuum
- B. Suction lift
- C. Center of the pump
- D. Pressure differential
- E. Negative suction head
- F. None of the Above

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

A. True B. False

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

A. True B. False

Pumps

285. Pumps are excellent examples of?

A. Hydrostatics D. Multi-stage pumps
B. Quasi-static E. Complicated part
C. Oscillating diaphragm F. None of the Above

286. Pumps are of two general types, _____ or positive displacement pumps, and pumps depending on dynamic forces, such as centrifugal pumps.

A. Hydrostatic D. Hydrostatic considerations
B. Quasi-static E. Complicated part
C. Oscillating diaphragm F. None of the Above

287. Positive displacement pumps have a piston moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.

A. True B. False

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

A. Pistons D. Passage in one direction
B. Diaphragms E. Lift pumps
C. Discharged fluid F. None of the Above

289. There are many kinds of _____, and can be the most trouble-prone and complicated part of a pump.

A. Rotors D. Air space
B. Force pumps E. Valves
C. Inlets F. None of the Above

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

A. Two check valves D. Cylinders
B. Diaphragms E. Lift pumps
C. Rotors F. None of the Above

291. The supply valve opens when the cylinder _____, the delivery valve when the cylinder volume decreases.

A. Rotor D. Air space
B. Force pump E. Volume increases
C. Volume decreases F. None of the Above

292. According to the text, the lift pump has a _____ and a valve in the piston that allows the liquid to pass around it when the volume of the cylinder is reduced.

- A. Supply valve
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Lift pumps
- F. None of the Above

293. 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

294. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston.

- A. True
- B. False

295. Which of the following terms 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

Pump Categories

296. The key to understanding a pumps operation is that 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

297. Pump operation like with a centrifugal pump — pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called?

- A. Inward force
- B. Head
- C. Viscous drag pump
- D. Center of the impeller
- E. Incompressible fluid
- F. None of the Above

298. According to the text, pumps may be classified on the basis of the application they serve.

- A. True
- B. False

Basic Water Pump

299. According to the text, the centrifugal pumps work by spinning water around in a circle inside a?

- A. Vortex
- B. Cylinder
- C. Viscous drag pump
- D. Center of the impeller
- E. Cylindrical pump housing
- F. None of the Above

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

- A. True
- B. False