

Registration Form

Water Treatment Utilization CEU Training 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

Name _____ **Signature** _____

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 _____

Technical Learning College TLC PO Box 3060, Chino Valley, AZ 86323
Toll Free (866) 557-1746 Fax (928) 272-0747 info@tlch2o.com

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DISCLAIMER NOTICE

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I fully understand that this type of study program deals with dangerous, changing conditions and various laws and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable in any fashion for any errors, omissions, advice, suggestions or neglect contained in this CEU education training course or for any violation or injury, death, neglect, damage or loss of your license or certification caused in any fashion by this CEU education training or course material suggestion or error or my lack of submitting paperwork. It is my responsibility to call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded. It is my responsibility to ensure all information is correct and to abide with all rules and regulations.

State Approval Listing Link, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. Do not solely trust our list for it may be outdated. It is your sole responsibility to ensure this course is accepted for credit.

Professional Engineers; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

You can obtain a printed version of the course manual from TLC for an additional \$69.95 plus shipping charges.

AFFIDAVIT OF EXAM COMPLETION

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

Grading Information

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

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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WATER TREATMENT UTILIZATION Answer Key

Name _____

Phone _____

You are solely responsible in ensuring that this course is accepted for credit by your State. No refunds. Did you check with your State agency to ensure this course is accepted for credit?

Method of Course acceptance confirmation. Please fill this section
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What is the approval number if Applicable? _____

PA DEP Students are required to complete the original version of the text. _____
Please initial

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 full-compliance and do not follow this course for proper compliance.

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

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

Rush Grading Service

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

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

**WATER TREATMENT UTILIZATION CEU COURSE
CUSTOMER SERVICE RESPONSE CARD**

NAME: _____

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

1. Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

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Very Easy 0 1 2 3 4 5 Very Difficult

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

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Any other concerns or comments.

Water Treatment Utilization 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.**

1. A public water system that serves _____ service connections used by year-round residents of the area served by the system or regularly serves at least 25 year-round residents.
A. At least 5 D. At least 30
B. At least 15 E. At least 500
C. 1,000 F. None of the Above
2. 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
3. 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
4. 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 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 is a broad classification for organic molecules of varied origin and composition within aquatic systems?
A. Activated alumina D. Dissolved organic carbon
B. Fluoride E. Aluminum salts
C. Activated carbon F. None of the Above
6. The "dissolved" fraction of which compound is considered an operational classification?
A. Activated alumina D. Organic carbon
B. Fluoride E. Aluminum salts
C. Activated carbon F. None of the Above

7. EDTA is a widely used abbreviation for the chemical compound Electrolysis acid.
 A. True B. False
8. 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 D. Ethylenediaminetetraacetic acid (EDTA)
 B. Dissolved organic carbon E. B and C
 C. Activated carbon F. None of the Above

Radionuclides

9. Some people who drink water containing _____ in excess of the EPA standard over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.
 A. Lead D. Aluminum
 B. Fluoride E. Arsenic
 C. Copper F. None of the Above
10. Some people who drink water containing this compound/element in excess of the EPA standard over many years may have an increased risk of getting cancer.
 A. Radon gas D. Alpha emitters
 B. Beta/photon emitters E. Combined Radium 226/228
 C. Radioactive mineral F. None of the Above

Other EPA Rules

Arsenic

11. Studies have linked long-term exposure of _____ in drinking water to a variety of cancers in humans.
 A. Arsenic D. THHMMS
 B. Copper E. Silica
 C. Basalt F. None of the Above
12. In October 2001, the EPA decided to move forward with implementing the 10ppb standard for _____ in drinking water.
 A. Arsenic D. Copper
 B. Trihalomethanes E. Disinfection byproducts (DBPs)
 C. Disinfection F. None of the Above
13. Which compound/element/substance is a chemical that occurs naturally in the earth's crust? When rocks, minerals, and soil erode, they release this compound/element/substance into water supplies.
 A. Arsenic D. Basalt
 B. Trihalomethanes E. Granite
 C. Disinfection byproducts F. None of the Above

ICR

14. 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

15. The ICR 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

16. Which of the following rules require EPA to develop rules to balance the risks between microbial pathogens and disinfection byproducts?

- A. Amendments to the SDWA in 1996 D. Stage 1 Disinfectant and Disinfection Byproduct Rule
B. Disinfectants E. The LT2 requirements
C. SDWA in 1996 F. None of the Above

17. The Stage 1 Disinfectants and Disinfection Byproducts Rule and _____, announced in December 1998, are the first of a set of rules under the 1996 SDWA Amendments.

- A. Groundwater Rule D. Long Term 2 Enhanced Surface Water Treatment Rule (LT2)
B. Compliance E. Interim Enhanced Surface Water Treatment Rule
C. SDWA in 1996 F. None of the Above

Public Health Concerns

18. While disinfectants are effective in controlling many microorganisms, they react with natural organic and inorganic matter in source water and distribution systems to form?

- A. DBPs D. Classes of DBPs
B. Chlorine and chloramine E. Ultraviolet light
C. Stage 2 DBPR F. None of the Above

19. Which of the following terms have also been shown to cause adverse reproductive or developmental effects in laboratory animals?

- A. DBPs D. Classes of DBPs
B. Chlorine and chloramine E. Ultraviolet light
C. Stage 2 DBPR F. None of the Above

20. More than 200 million people consume water that has been disinfected. Because of the large population exposed, health risks associated with _____, even if small, need to be taken seriously.

- A. DBPs D. Classes of DBPs
B. Chlorine and chloramine E. Ultraviolet light
C. Stage 2 DBPR F. None of the Above

21. Which of the following rules and Disinfection Byproducts Rule applies to all community and nontransient non-community water systems that treat their water with a chemical disinfectant?

- A. Groundwater Rule D. Long Term 2 Surface Water Treatment Rule
B. The Stage 1 Disinfectants E. Interim Enhanced Surface Water Treatment Rule
C. SDWA in 1996 F. None of the Above

22. Which of the following rules and Disinfection Byproduct Rule updates and supersedes the 1979 regulations for total trihalomethanes?

- A. DBPs D. Stage 1 Disinfectant and Disinfection Byproduct Rule
B. The Stage 1 Disinfectant E. The LT2 requirements
C. SDWA in 1996 F. None of the Above

Stage 2 DBP Rule Federal Register Notices

23. Which of the following rules is part of the Microbial and Disinfection Byproducts Rules, 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

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

- A. Stage 2 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

25. 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

26. 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

27. 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

28. There are specific microbial pathogens, such as _____, which can cause illness, and are highly resistant to traditional disinfection practices.

- A. Enteric virus(es)
- B. Oocyst(s)
- C. Cryptosporidium
- D. C. perfringens
- E. E. coli host culture
- F. None of the Above

29. The Stage 1 Disinfectants and Disinfection Byproducts Rule and _____, promulgated in December 1998.

- A. Major public health advances
- B. The Stage 2 DBPR
- C. This final rule
- D. Amendments to the SDWA in 1996
- E. Interim Enhanced Surface Water Treatment Rule
- F. None of the Above

30. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) builds upon the _____ to address higher risk public water systems for protection measures beyond those required for existing regulations.

- A. Stage 2 DBPR
- B. DBP exposure
- C. Stage 1 DBPR
- D. Long Term 2 Enhanced Surface Water Treatment Rule
- E. Traditional disinfection practices
- F. None of the Above

31. Which of the following rules along with the Long Term 2 Enhanced Surface Water Treatment Rule are the second phase of rules required by Congress?
- A. Major public health advances D. Amendments to the SDWA in 1996
 B. The Stage 2 DBPR E. Primary or residual disinfectant
 C. This final rule F. None of the Above
32. Which Rule will reduce potential cancer and reproductive and developmental health risks from disinfection byproducts (DBPs) in drinking water, which form when disinfectants are used to control microbial pathogens?
- A. Stage 3 DBPR D. Long Term 2 Enhanced Surface Water
 B. DBP exposure E. Traditional disinfection practices
 C. Stage 2 Disinfection Byproducts F. None of the Above
33. Which Rule strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5)?
- A. Major public health advances D. Amendments to the SDWA in 1996
 B. The Stage 3 DBPR E. Primary or residual disinfectant
 C. Stage 2 Disinfection Byproducts F. None of the Above
34. Which of the following rules targets systems with the greatest risk and builds incrementally on existing rules?
- A. Stage 2 DBPR D. Long Term 2 Enhanced Surface Water Treatment Rule
 B. The rule E. Traditional disinfection practices
 C. The Stage 1 DBP rule F. None of the Above
35. Which of the following rules is being promulgated simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule to address concerns about risk tradeoffs between pathogens and DBPs?
- A. Major public health advances D. Amendments to the SDWA in 1996
 B. The Stage 2 DBPR E. Primary or residual disinfectant
 C. This final rule F. None of the Above
36. Which of the following terms systems will conduct an evaluation of their distribution systems, known as an Initial Distribution System Evaluation?
- A. Stage 2 DBPR D. Long Term 2 Enhanced Surface Water Treatment Rule
 B. DBP exposure E. Traditional disinfection practices
 C. The Stage 1 DBP rule F. None of the Above
37. Compliance with the maximum contaminant levels for two groups of disinfection byproducts (TTHM and HAA5) will be calculated for each monitoring location in the distribution system. This approach is referred to as the?
- A. TTHM and HAA5 D. Disinfection byproducts (DBPs)
 B. DBP MCLs E. Trihalomethanes and haloacetic acids
 C. Locational running annual average (LRAA) F. None of the Above
38. Which of the following rules also requires each system to determine if they have exceeded an operational evaluation level, which is identified using their compliance monitoring results?
- A. Stage 2 DBPR D. Long Term 2 Enhanced Surface Water Treatment Rule
 B. DBP exposure E. Traditional disinfection practices
 C. The Stage 1 DBP rule F. None of the Above

Who must comply with the rule?

39. Which of the following rules will community and nontransient noncommunity water systems that produce and/or deliver water that is treated with a primary or residual disinfectant other than ultraviolet light?

- A. DBPs from chlorination
- B. Chlorine and chloramine
- C. Stage 2 DBPR
- D. Classes of DBPs
- E. TTHM and HAA5
- F. None of the Above

40. Which of the following terms is a public water system that serves year-round residents of a community, subdivision, or mobile home park that has at least 15 service connections or an average of at least 25 residents?

- A. Trailer park
- B. A non-community water system
- C. A community water system (CWS)
- D. NTNCWS
- E. A nontransient water system
- F. None of the Above

41. Which of the following terms is a water system that serves at least 25 of the same people more than six months of the year, but not as primary residence, such as schools, businesses, and day care facilities?

- A. Trailer park
- B. A non-community water system
- C. A community water system (CWS)
- D. NTNCWS
- E. A nontransient water system
- F. None of the Above

Water Treatment Section

Preliminary Treatment

42. Weeds, leaves, and trash, if not removed, 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

Pre-Sedimentation

43. 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

44. Sedimentation basins are also used after the flocculation process.

- A. True
- B. False

45. 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
- B. Conveyor belts
- C. Dissolved air floatation
- D. Manual skimmers
- E. Turnstile
- F. None of the Above

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

- A. True
- B. False

Flights and Chains

47. 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
48. 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
49. 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

Circular Clarifiers

50. The most common type of Circular Clarifier has a center pier or column.
A. True B. False
51. The _____ process uses alum (aluminum sulfate) and cationic polymer to neutralize the charge.
A. Filtration D. Flocculation
B. Reconditioning E. Conventional
C. Purification F. None of the Above
52. 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
53. _____ 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
54. Which of the following systems use graded silica sand filter media?
A. Conventional technology D. All of the above except C
B. Reconditioning cycle E. Chemical pretreatment
C. Membranes F. None of the Above
55. Filtration occurs only within the last few inches of the courser materials at the bottom of the bed.
A. True B. False
56. The media becomes progressively finer and denser in the lower layers.
A. True B. False
57. As suspended particles accumulate in a Filter bed - the pressure drop through the filter increases.
A. True B. False

58. 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

59. 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

60. 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

61. _____ 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

62. 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

63. _____ 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

64. 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

65. 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 D. Fast rinse
B. Reconditioning cycle E. Chemical pretreatment
C. Sedimentation process F. None of the Above

Rapid Sand Filtration

66. _____ is the most prevalent form of water treatment technology in use today.

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

67. 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

68. 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

69. 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

70. 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

71. Aluminum Sulfate is also excellent for removing nutrients such as phosphorous in wastewater treatment.

- A. True
- B. False

72. 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
- B. Coagulation
- C. Coagulant chemicals
- D. Flocculation
- E. All of the Above
- F. None of the Above

73. 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

74. Which of the following terms 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

75. Coagulation is necessary to meet the current regulations for almost all potable water plants using surface water.

- A. True
- B. False

76. Coagulant chemicals such as "alum" work by neutralizing the negative charge, which allows the particles to come together.

- A. True
- B. False

77. 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
78. 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
79. 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
80. 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
81. 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
82. More than 98% of poliovirus type 1 is 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

Flocculation

83. 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
84. Flocculation is the process where the suspended particles can collide, _____, and form heavier particles called "floc".
- A. Equalization D. Destabilized or coagulated particles
 B. Agitation of the water E. All of the Above
 C. Agglomerate F. None of the Above
85. Gentle _____ and appropriate detention times help facilitate the flocculation process.
- A. Equalizing D. Settling
 B. Agitation of the water E. All of the Above
 C. Agglomerating F. None of the Above

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

- A. True B. False

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

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

Pre-Sedimentation

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

Sedimentation

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

- A. True B. False

90. Following _____, a sedimentation step may be used. During sedimentation, the velocity of the water is decreased so that the suspended material, including flocculated particles, can settle out by gravity.

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

91. 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

92. Which of the following terms 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

93. 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

94. 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

95. Water filters for suspended particle removal can also be made of graded sand, _____, screens of various materials, and fabrics.

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

96. 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

97. 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

98. Evaluation of overall _____ 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

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

- A. True
- B. False

Declining Rate Filters

100. 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

101. 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

102. 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

103. Chlorine is added to the water at the flash mix for pre-disinfection. The chlorine kills or inactivates harmful microorganisms.

- A. True
- B. False

104. 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

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

pH

106. 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

107. 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

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

- A. True
- B. False

Polymer

109. 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

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

- A. True
- B. False

Pre-Chlorination

111. The addition of chlorine before the filtration process will help: control fish and vegetation.

- A. True
- B. False

Hydrofluosilicic Acid

112. 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

113. 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

114. 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

115. 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

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

- A. True
- B. False

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

- A. True
- B. False

118. 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

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

- A. True
- B. False

120. 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

121. 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

122. 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

123. Tube settlers are a modification of the conventional process that 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

124. 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

125. 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

126. 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

127. 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

EPA Filter Backwash Rule

128. 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

Turbidity

129. Which of the following terms 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

130. 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

131. 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

Other Requirements

132. 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

133. 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. A sieve or microstrainer
- D. Physical and chemical mechanisms
- E. Treatment process
- F. None of the Above

134. 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. Mud balling
- F. None of the Above

Types of Filters

135. Most water filters are classified by filtration rate, type of _____, or type of operation.

- A. Schmutzdecke
- B. Slow rate filtration
- C. Backwash capabilities
- D. Filter media
- E. Filter size
- F. None of the Above

Rapid Sand Filters

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

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

137. 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

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

- A. True
- B. False

139. The gravel installed under the sand layer(s) in the filter prevents the _____ from being lost during the operation.

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

False floor

140. 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

Leopold System

141. 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
- B. Surface wash system
- C. Media
- D. Backwashing of the filter or backwash cycle
- E. Removed filtered water
- F. None of the Above

Washwater Troughs

142. During the operation of a filter, the upper six-to-ten inches of the filter media remove most of the suspended material; this layer is thoroughly cleaned during the _____.

- A. Rinsing cycle
- B. Method of agitation
- C. Washing
- D. Backwash cycle
- E. Filtered water cycle
- F. None of the Above

143. 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

144. 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

145. 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

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

- A. True
- B. False

147. 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

High Rate Filters

148. 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

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

- A. True
- B. False

150. 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 with larger grains
- E. Top of the sand layer with finer grains
- F. None of the Above

151. In the design of the high rate filter?

- A. Finer material are farther down
- B. The media size decreases
- C. Larger suspended particles are removed first
- D. The media size increases
- E. Water is treated better
- F. None of the Above

Pressure Sand Filters

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

- A. True
- B. False

153. 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

Filtration Operation

154. 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

155. 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

156. Which of the following terms is a relatively recent membrane process that is 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

157. 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

158. 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

159. 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

160. 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

161. 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

162. 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

In-line Turbidimeter

163. 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

164. Which of the following terms in water is caused by small suspended particles that scatter or reflect light?

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

165. Which of the following terms of the filtered water may shelter bacteria, preventing chlorine from reaching it?

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

166. The _____ of the filtered water is one of the factors that determine the length of a filter run.

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

167. _____ measurements will also indicate whether the coagulation and other treatment processes are operating properly.

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

Filtration Process

168. 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

169. Water from the source or 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

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

- A. True
- B. False

171. 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

172. 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

173. 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

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

- A. True
- B. False

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

- A. True
- B. False

176. 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

177. 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

178. Which of the following terms must be expanded to clean the filter during the backwash?

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

179. Filter media expansion causes the filter grains to violently rub against each other, dislodging the _____ from the media.

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

180. 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
- B. Floc(s)
- C. Flow restricting
- D. Backwash cycle
- E. Media
- F. None of the Above

181. 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
- B. Floc(s)
- C. Flow restricting
- D. Backwash rate
- E. Media
- F. None of the Above

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

- A. True
- B. False

183. According to the text, a newer method of surface wash involves using _____ before the water wash.

- A. Headloss calculation
- B. Floc(s) scouring
- C. Air scour
- D. Backwash cycle
- E. Air washing
- F. None of the Above

184. The normal design for the _____ will be two-to-five cubic feet of air per square foot of filter area.

- A. Headloss calculation
- B. Floc(s) scouring
- C. Air scour
- D. Backwash cycle
- E. Air wash
- F. None of the Above

185. The filter should be backwashed when the _____ is so high that the filter no longer produces water at the desired rate.

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

186. 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

Backwashing Process

187. 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

188. 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

189. 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

190. 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

191. 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

192. 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

193. 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

194. The best way to determine how long the filter should be washed is to measure the turbidity of the?

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

195. Which of the following terms must be treated after use, and backwash valves must be opened slowly?

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

196. Opening the valves too rapidly can cause _____, filter gravel, and filter media.

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

Disposal of Filter Backwash Water

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

- A. True
- B. False

198. 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

199. 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

200. 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

201. 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

202. When filtration is started after backwashing, 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

203. According to the text, 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

Filter Aids

204. 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

205. 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

Filter Operating Problems

206. 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

207. 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

208. 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

Control of Filter Flow Rate

209. 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

210. 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

Hard Water Section

211. Water contains various amounts of _____, some of which impart a quality known as hardness.

- A. Water hardness
- B. Carbonate hardness
- C. The calcium-magnesium distinction
- D. Calcium (Ca) and magnesium (Mg)
- E. Dissolved minerals
- F. None of the Above

Occurrence of Hard Water

212. 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
- B. Metallic cations
- C. Carbon dioxide (CO₂)
- D. Calcium (Ca) and magnesium (Mg)
- E. Noncarbonate hardness
- F. None of the Above

Membrane Filtration Processes

213. In particular, _____ enables some water systems having contaminated water sources to meet new, more stringent regulations.

- A. Membrane technology
- B. Macromolecule(s)
- C. Solute(s)
- D. Conventional thermal separation process(es)
- E. Direct filtration
- F. None of the Above

Description of Membrane Filtration Processes

214. 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)
- B. Fractional distillation
- C. Membrane processes
- D. A selective barrier
- E. Thermal separation method(s)
- F. None of the Above

Microfiltration

215. 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

Ultrafiltration

216. Although UF does not generally work well for removal of _____, it can be used effectively for removal of 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

217. 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

218. 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

219. 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

220. This process works most organic chemicals, and radionuclides and microorganisms.

- 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

221. 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

222. Which of the following terms works with such as ultrafiltration and reverse osmosis to provide a product stream that 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

223. 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

224. 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.
- A. True
 - B. False

225. Which of the following terms produces high quality water at low cost compared to other purifications processes?
- A. Pressure differential
 - B. Osmotic pressure
 - C. Higher molecular weights
 - D. RO
 - E. Waste (concentrate)
 - F. None of the Above

226. Which of the following is determined by the total dissolved solids content of the saline solution, or contaminated solution on one side of the membrane?
- A. This pressure differential
 - B. Osmotic pressure
 - C. Higher molecular weights
 - D. Virtually 100% of colloidal and suspended matter
 - E. Waste (concentrate)
 - F. None of the Above

227. The higher the content of dissolved solids, the higher the?
- A. Pressure differential
 - B. Osmotic pressure
 - C. Higher molecular weights
 - D. Virtually 100% of colloidal and suspended matter
 - E. Waste (concentrate)
 - F. None of the Above

228. 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

229. According to the text, common tap water as found in most areas may have an osmotic pressure of about 10 PSI (Pounds per Square Inch), 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

230. According to the text, Seawater at _____ typically has an osmotic pressure of about 376 PSI (26.75 Bar).
- A. 36,000 PPM
 - B. A pressure of 10 PSI
 - C. Osmotic pressure(s)
 - D. 1.68 Bar
 - E. 56 PSI
 - F. None of the Above

231. To reach the point at which osmosis stops for tap water, a pressure of 10 PSI would have to be applied to the saline solution, and to stop osmosis in seawater, a pressure of _____ would have to be applied to the seawater side of the membrane.
- 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

232. 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

233. 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

234. 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

235. Ozone does not form chloramines or _____, and while it may destroy some THMs, it may produce other 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

236. 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 to be determined.

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

Bacteriological Monitoring Section

237. 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

238. Which of the following terms is used to 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

239. 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

240. Refrigerate the sample and transport it to the testing laboratory within eight hours (in an ice chest). 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

241. Which bug 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 D. Escherichia coli (E. coli)
B. Algae E. Iron bacteria
C. Coliform bacteria F. None of the Above

242. Which of the following 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 that distribute water, and indicates that the water may be contaminated with germs that can cause disease?

- A. Diseases D. Escherichia coli (E. coli)
B. Germs E. Iron bacteria
C. Coliform bacteria F. None of the Above

Laboratory Procedures

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

Methods

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

The three (3) types of samples are:

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

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

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

Repeat Sampling

247. 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:

248. 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

Sampling Procedures

249. Which of the following must be followed and all operating staff must be clear on how to follow the sampling plan?

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

Positive or Coliform Present Results

250. 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

Heterotrophic Plate Count HPC

251. 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

Membrane Filter Method

252. 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)

253. 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

Public Notice

254. A public notice is required to be issued by a water system whenever it fails to comply with an applicable MCL or _____, or fails to comply with the requirements of any scheduled variance or permit.

- A. Routine analysis
- B. Drinking water rule
- C. *Treatment technique*
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

255. Which missing term best describes what also is required whenever a water system fails to comply with its monitoring and/or reporting requirements or testing procedure?

- A. Routine analysis
- B. Drinking water rule
- C. MCL violation
- D. Public notice
- E. Fecal coliform or E. coli present count
- F. None of the Above

256. There shall be certain information, be issued properly and in a timely manner, and contain certain _____ on the public notice.

- A. Legal analysis
- B. Drinking water rule information
- C. NOVs
- D. Mandatory language
- E. Fecal language
- F. None of the Above

257. If there is a(n) _____ present to users, the timing and place of posting of the public notice may have different priorities.

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

The following are acute violations:

258. Which is violation of nitrate?

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

259. 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

260. 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

Pathogen Section

261. Bacteria, viruses and protozoan that cause disease are known as pathogens.

- A. True
- B. False

262. 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

263. 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

264. This term means that it in nature is different from other types of pathogens such as the viruses that cause influenza (the flu) or the bacteria that cause tuberculosis.

- A. Fecal Coliform and E coli
- B. Giardia lamblia
- C. Microorganism(s)
- D. *Waterborne Pathogen(s)*
- E. Coliform bacteria
- F. None of the Above

Protozoan Diseases

265. _____ 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

Giardia lamblia

266. Which of the following pathogens has been responsible for more community-wide outbreaks of disease in the U.S. than any other pathogen?

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

Cryptosporidiosis

267. 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

268. All of these diseases, with the exception of which 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

General Contaminant Information

269. Which of the following terms, such as salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming?

- A. Viruses and bacteria
- B. Pesticides and herbicides
- C. Radioactive contaminants
- D. Inorganic contaminants
- E. Organic chemical contaminants
- F. None of the Above

Chlorine Gas

Pathophysiology

270. 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

Mechanism of Activity

271. 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

Solubility Effects

272. 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

273. Chlorine gas when mixed with ammonia, reacts to form _____.

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

Immediate Effects

274. 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

275. Chlorine is a highly reactive gas.

- A. True
- B. False

Exposure

276. There is no threshold value for to sodium hypochlorite exposure. Various health effects occur after exposure to sodium hypochlorite. People are exposed to sodium hypochlorite by inhalation of aerosols.

- A. True B. False

Routes of Exposure Inhalation

277. Chlorine is lighter than air and may cause asphyxiation in poorly ventilated, enclosed, or high-lying areas.

- A. True B. False

Chemistry of Chlorination

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

- A. True B. False

279. 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

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

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

281. Which of the following terms is where the chlorine demand has been satisfied, and any additional chlorine will be considered free chlorine?

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

Residual Concentration/Contact Time (CT) Requirements

282. Since monitoring for very low levels of pathogens in treated water is analytically very difficult, utilizing the _____ is recommended to demonstrate satisfactory treatment.

- A. Free chlorine D. "CT" disinfection concept
B. Total residual E. T10 of the process unit
C. Free chlorine residual F. None of the Above

Calculation and Reporting of CT Data

283. Reduction Ratio should be reported, along with the appropriate pH, temperature, and?

- A. Reduction Ratio D. Disinfectant residual
B. CT actual E. T10 of the process unit
C. Free chlorine residual F. None of the Above

Chlorination Equipment Requirement Section

284. Which of the following should be located to minimize the length of pressurized chlorine solution lines?

- A. Gas vacuum line D. Mechanical gas proportioning equipment
B. Vacuum regulators E. Injectors
C. Manual chlorine feed systems F. None of the Above

285. Which of the following shall have the capacity to dose enough chlorine to overcome the demand and maintain the required concentration of the "free" or "combined" chlorine.

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

Methods of Control

286. Which of the following shall be automatic proportional controlled, automatic residual controlled, or compound loop controlled?

- A. 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

Chlorine Leak Detection

287. Which of the following related chlorine alarm equipment should be connected to a remote audible and visual alarm system and checked on a regular basis to verify proper operation.

- A. The chlorinator
- B. The facility
- C. All chlorine cylinders
- D. The chlorine gas leakage
- E. Chlorine leak detection equipment
- F. None of the Above

288. Which of the following related chlorine alarm equipment shall not automatically activate the chlorine room ventilation system in such a manner as to discharge chlorine gas?

- A. Caustic soda solution reaction tanks
- B. Corrosion resistant
- C. Leak detection equipment
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

Chlorine Room Design Requirements

289. Where gas chlorination is practiced, the gas cylinders and/or the ton containers up to the vacuum regulators shall be housed in a gas-tight, well-illuminated, corrosion resistant and_____.

- A. Mechanically ventilated enclosure
- B. Corrosion resistant
- C. Securely positioned
- D. Automatic chlorine leak detection
- E. Chlorine room ventilation system
- F. None of the Above

Storage of Chlorine Cylinders

290. Sometimes entry in very large facilities, may be through a vestibule from outside in to?

- A. Cylinders or containers access
- B. The outside of the room
- C. Chlorine rooms
- D. Uncontrolled release of spilled gas
- E. Air inlets
- F. None of the Above

Scrubbers

291. According to the text, facilities located within residential or densely populated areas, consideration shall be given to provide scrubbers for_____.

- A. A panic button
- B. The chlorine room
- C. Scrubber(s)
- D. The chlorine gas storage room
- E. The chlorine cylinder storage room
- F. None of the Above

Chlorine Exposure Limits

292. 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

293. Cl₂ IDLH?

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

294. Cl₂ Fatal Exposure Limit?

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

295. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for chlorine is 10 PPM (3 milligrams per cubic meter (mg/m³)) as a ceiling limit. A worker's exposure to chlorine shall at no time exceed this ceiling level.

- A. True
- B. False

296. When using chlorine gas: In addition to protective clothing and goggles, chlorine gas should be used only in a well-ventilated area so that _____ cannot concentrate.

- A. Chlorine exposure
- B. Connection
- C. Leak area
- D. Any leaking gas
- E. Several safety precautions
- F. None of the Above

297. HOCl and OCl⁻: The OCl⁻ is the hypochlorite ion and both of these species are known as free available chlorine, they are the two main chemical species formed by chlorine in water and they are known collectively as _____ and the _____.

- A. Hypochlorous acid, Cl₂
- B. Hypochlorous acid, Hypochlorite ion
- C. HOCl₂ and OCl₂
- D. Combined Available Chlorine, Total
- E. Monochloramine, Cl₂
- F. None of the Above

298. Which of the following terms when added to water, rapidly hydrolyzes, the chemical equations best describe this reaction is Cl₂ + H₂O → H⁺ + Cl⁻ + HOCl?

- A. Chlorine gas
- B. Cl
- C. HOCl and OCl⁻
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

299. Which of the following substances is the most germicidal of the chlorine compounds with the possible exception of chlorine dioxide?

- A. Hydrochlorous acid
- B. Sulfuric acid
- C. Hypochlorous acid
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

300. Yoke-type connectors should be used on a _____ assuming that the threads on the valve may be worn.

- A. Chlorine regulator
- B. Connection
- C. Leak area
- D. Protective bonnet
- E. Chlorine cylinder's valve
- F. None of the Above

301. What is the Atomic number of chlorine?

- A. 17 7
- B. 17
- C. 0.17
- D. 17 PPM
- E. 23
- F. None of the Above

302. _____ is the elemental symbol and _____ is the chemical formula.

- A. Cl, Cl₂
- B. Cl₂, Cl
- C. HOCl and OCl⁻
- D. Chlorine, Cl₂
- E. Cl₂, ClH₄
- F. None of the Above

303. Monochloramine, _____, and trichloramine are also known as Combined Available Chlorine. Cl₂ + NH₄.

- A. Cl₂
- B. Dichloramine
- C. HOCl and OCl⁻
- D. Combined Available Chlorine
- E. Monochloramine
- F. None of the Above

Pump, Motor and Hydraulic Section

Common Hydraulic Terms

304. 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

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

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

306. Which of the following definitions is the pressure applied to a confined fluid at rest is transmitted with equal intensity throughout the fluid?

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

307. Which of the following definitions is the application of continuous force by one body upon another that it is touching; compression?

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

308. 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

309. 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

310. 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

311. 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

312. 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

313. 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

314. 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

315. 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

316. 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

317. 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

318. 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

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

- A. True
- B. False

Pump Definitions

320. Which of the following definitions is a bushing used to compress the packing in the stuffing box and to control leakoff?

- A. Leak-off packing
- B. Gland sealing line
- C. Horizontal packing
- D. Lantern ring
- E. Gland follower
- F. None of the Above

321. Which of the following definitions are pumps in which the centerline of the shaft runs vertically?

- A. Thrusters
- B. Vanes
- C. Suction pumps
- D. Vertical pumps
- E. Double pumps
- F. None of the Above

322. Which of the following definitions are replaceable tubular coverings on the shaft?

- A. Protectors
- B. Shrouds
- C. Covers
- D. Shaft sleeve
- E. Stages
- F. None of the Above

323. Which of the following definitions is the metal covering over the vanes of an impeller?

- A. Slop drain
- B. Shroud
- C. Slurry
- D. Shaft sleeve
- E. Stages
- F. None of the Above

324. Which of the following definitions is the drain from the area that collects leak-off from the stuffing box?

- A. Slop drain
- B. Shroud
- C. Slurry drain
- D. Shaft sleeve
- E. Stages
- F. None of the Above

325. Which of the following definitions the part of the pump that changes the speed of the fluid into pressure?

- A. Thrust
- B. Vanes
- C. Suction eye
- D. Vertical pumps
- E. Volute
- F. None of the Above

326. Which of the following definitions are the replaceable rings on the impeller or the casing that wear as the pump operates.

- A. Seals
- B. Vanes
- C. Packing glands
- D. Glands
- E. Wearing rings
- F. None of the Above

327. Which of the following definitions is a nut that keeps the parts in place?

- A. Lock nut
- B. Keyway
- C. Cotter
- D. Radial bearings
- E. Retaining nut
- F. None of the Above

328. Which of the following definitions are the rotating parts, usually including the impeller, shaft, bearing housings, and all other parts included between the bearing housing and the impeller?

- A. Inboard
- B. Rotor
- C. Mechanical
- D. Flow parts
- E. Retaining parts
- F. None of the Above

329. Which of the following definitions is to cause lines, grooves, or scratches?

- A. Wear
- B. Burn
- C. Score
- D. Scratch
- E. Grover
- F. None of the Above

330. Which of the following definitions is a cylindrical bar that transmits power from the driver to the pump impeller?

- A. Radial flow
- B. Shaft
- C. Transfer
- D. Gear driver
- E. Keyway
- F. None of the Above

331. Which of the following definitions is the place where fluid enters the pump?

- A. Strainer
- B. Suction
- C. Entrance
- D. Stuffing box
- E. Throat
- F. None of the Above

332. Which of the following definitions are bearings that prevent shaft movement in any direction outward from the centerline of the pump?

- A. Volute
- B. Rotor
- C. Spider
- D. Radial bearings
- E. Retaining bearings
- F. None of the Above

333. Which of the following definitions is flow at 90° to the centerline of the shaft?

- A. Radial flow
- B. Reverse
- C. Score
- D. Vertical
- E. Horizontal
- F. None of the Above

334. Which of the following definitions is a device that retains solid pieces while letting liquids through?

- A. Strainer
- B. Lantern ring
- C. Suction eye
- D. Stuffing box
- E. Throat bushing
- F. None of the Above

335. Which of the following definitions is the area of the pump where the shaft penetrates the casing?
 A. Strainer D. Stuffing box
 B. Leak-off E. Throat bushing
 C. Suction eye F. None of the Above
336. Which of the following definitions is the place where fluid enters the pump impeller?
 A. Strainer D. Stuffing box
 B. Suction E. Throat
 C. Suction eye F. None of the Above
337. Which of the following definitions are pumps in which the centerline of the shaft is horizontal?
 A. Dynamic D. Turbine
 B. Centrifugal E. Radical flow
 C. Horizontal pumps F. None of the Above
338. Which of the following definitions are bearings that prevent shaft movement back and forth in the same direction as the centerline of the shaft?
 A. Thrust D. Vertical
 B. Spider E. Thrust bearings
 C. Suction F. None of the Above
339. Which of the following definitions are parts of the impeller that push and increase the speed of the fluid in the pump?
 A. Thrusters D. Bowls
 B. Vanes E. Volute
 C. Drivers F. None of the Above
340. Which of the following definitions is a thick, viscous fluid, usually containing small particles?
 A. Slop D. Drawdown
 B. Mixed liquid E. Mud
 C. Slurry F. None of the Above
341. Which of the following definitions are Impellers in a multi-stage pump?
 A. Volute D. Shaft stages
 B. Shrouds E. Stages
 C. Bowls F. None of the Above
342. Which of the following definitions are pumps with more than one impeller?
 A. Turbine D. Multi-stage pumps
 B. Mixed flow E. Outboard
 C. Inboard F. None of the Above
343. Which of the following definitions is the end of the pump farthest from the motor?
 A. Outlet D. Exit
 B. Impeller E. Outboard
 C. Inboard F. None of the Above
344. Which of the following definitions is the soft, pliable material that seals the stuffing box?
 A. Packing D. Glands
 B. Rubbers E. Mechanical seal
 C. Gaskets F. None of the Above

Pumps

345. 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

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

- A. True
- B. False

347. 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

348. 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

349. The force pump has two valves in the cylinder, while the lift pump has one valve in the cylinder and one in the piston.

- A. True
- B. False

350. Which of the following terms is determined by the atmospheric pressure, and either cylinder must be within this height of the free surface?

- A. Suction
- B. Diaphragm
- C. Discharged fluid
- D. Discharge
- E. Force
- F. None of the Above

351. The force pump can give an arbitrarily large pressure to the _____, as in the case of a diesel engine injector.

- A. Rotor
- B. Discharged fluid
- C. Volume decreases
- D. Air space
- E. Delivery
- F. None of the Above

352. Fire fighting force pumps usually have two cylinders feeding one receiver alternately.

- A. True
- B. False

353. The air space in the receiver helps to make the?

- A. Rotor
- B. Water pressure uniform
- C. Volume decreases
- D. Air space
- E. Delivery
- F. None of the Above

354. The Roots blower has no valves, their place taken by the _____ between the rotors and the housing.

- A. Piston
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Sliding contact
- F. None of the Above

355. The Roots blower can either exhaust a receiver or provide _____ under moderate pressure, in large volumes.

- A. Air
- B. Mixed flow
- C. Dynamic
- D. Discharge tube
- E. Roots blower
- F. None of the Above

356. The Bellows is a very old device, requiring no accurate machining.

- A. True
- B. False

357. The single valve is in one or both sides of the expandable?

- A. Cylinder
- B. Chamber
- C. Radial flow
- D. Cavity
- E. Positive Displacement Pump(s)
- F. None of the Above

358. Which of the following terms uses the valve on the valve stem of the tire or inner tube to hold pressure in the tire?

- A. Bellows pump
- B. Chamber pump
- C. Radial flow pump
- D. Bicycle pump
- E. Positive Displacement Pump
- F. None of the Above

359. Which of the following terms, which is attached to the discharge tube, has a flexible seal that seals when the cylinder is moved to compress the air, but allows air to pass when the movement is reversed?

- A. Piston
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Sliding contact
- F. None of the Above

360. According to the text, diaphragm and vane pumps act the same way by varying the volume of a chamber, and directing the flow with?

- A. Cylinder
- B. Check valves
- C. Radial flow
- D. Cavity
- E. Positive Displacement Pump(s)
- F. None of the Above

Pump Categories

361. 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

362. 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

363. According to the text, pumps may be classified based on the application they serve.

- A. True
- B. False

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

Basic Water Pump

365. 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

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

367. 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

368. 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

369. 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

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

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

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

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

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

375. In the operation of the pump, the water at the edge of the _____ inward on the water between the impeller blades and makes it possible for that water to travel in a circle.

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

376. In the operation of the pump, when water is actively flowing through the pump, arriving through a hole near the center of the impeller and leaving through a _____ near the outer edge of the pump housing, the pressure rise between center and edge of the pump is not as large.

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Hole
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

Venturi (Bernoulli's law):

377. A venturi is a pipe that has a gradual restriction that opens up into a gradual enlargement.

- A. True
- B. False

378. The area of the restriction in a venture will have a _____ than the enlarged area ahead of it.

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

379. Which of the following terms best describes a pump whose impeller has no vanes but relies on fluid contact with a flat rotating plate turning at high speed to move the liquid.

- A. Submersible
- B. Blower
- C. Viscous drag pump
- D. Rotary pump
- E. Bicycle pump
- F. None of the Above

Types of Water Pumps

380. The rotating shaft in a line shaft turbine is actually housed within the column pipe that delivers the water to the surface.

- A. True
- B. False

381. The size of the _____ are selected based on the desired pumping rate and lift requirements.

- A. Spider bearing(s)
- B. Horsepower
- C. Impeller(s)
- D. Column, impeller, and bowls
- E. Desired pumping rate
- F. None of the Above

382. According to the text, column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by?

- A. Oil tube
- B. Spider bearings
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above

383. The water passing through the column pipe serves as the lubricant for the bearings.

- A. True
- B. False

384. Which of the following terms, provide both a seal at the column pipe joints and keep the shaft aligned within the column?

- A. Spider bearing(s)
- B. Keyway
- C. Impeller(s)
- D. Roller bearings
- E. Lantern rings
- F. None of the Above

385. Some vertical turbines are lubricated by oil rather than water. These pumps are essentially the same as _____; only the drive shaft is enclosed within an oil tube.

- A. Oil tube
- B. Water lubricated units
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above

386. The oil tube is suspended within the column by _____, while the line shaft is supported within the oil tube by brass or redwood bearings.

- A. Oil tube
- B. Spider flanges
- C. Column pipe
- D. Single or multiple bowls
- E. Pump's lifting capacity
- F. None of the Above

387. A continuous supply of _____ the drive shaft as it proceeds downward through the oil tube.

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

388. A small hole located at the top of the _____ allows excess oil to enter the well. This results in the formation of an oil film on the water surface within oil-lubricated wells.

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

389. Careful operation of oil lubricated turbines is needed to ensure that the pumping levels do not drop enough to allow oil to enter the pump.

- A. True
- B. False

390. According to the text, water and oil lubricated turbine pump units can be driven by?

- A. Gears
- B. Drive shaft
- C. Column pipe
- D. Electric or fuel powered motors
- E. Pump's lifting capacity
- F. None of the Above

391. Often an electric motor that is connected to the _____ by a keyway and nut.

- A. Drive shaft
- B. Rotor
- C. Inboard
- D. Sprocket
- E. Time delay or ratchet assembly
- F. None of the Above

392. Where electricity is not readily available, fuel powered engines may be connected to the drive shaft by a?

- A. Gear
- B. Lantern ring
- C. Drive shaft
- D. Volumetric positive displacement
- E. Right angle drive gear
- F. None of the Above

393. Oil and water lubricated systems will have a strainer attached to the _____ to prevent sediment from entering the pump.

- A. Intake
- B. Diaphragm
- C. Inboard
- D. Lantern ring
- E. Sump
- F. None of the Above

394. Which of the following terms: water flowing back down the column, turning the impellers in a reverse direction?

- A. Vapor bubbles are created
- B. Chamber pressure
- C. Drive shaft is off
- D. Volumetric positive displacement is turned off
- E. Line shaft turbine is turned off
- F. None of the Above

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

- A. Reverse rotation
- B. Diaphragm
- C. Inertial cavitation
- D. Keyway and nut
- E. Time delay or ratchet assembly
- F. None of the Above

There are three main types of diaphragm pumps:

396. In the first type, the _____ with one side in the fluid to be pumped, and the other in air or hydraulic fluid.

- A. Vapor bubbles
- B. Chamber pressure
- C. Drive shaft
- D. Volumetric positive displacement
- E. Diaphragm is sealed
- F. None of the Above

397. The diaphragm is flexed, causing the volume of the pump chamber to increase and decrease.

- A. True
- B. False

398. A pair of _____ prevents reverse flow of the fluid.

- A. Strainers
- B. Diaphragms
- C. Springs
- D. Non-return check valves
- E. Check valves
- F. None of the Above

399. The second type of diaphragm pump works with volumetric positive displacement, but differs in that the prime mover of the diaphragm is neither oil nor air; but is?

- A. Vapor bubbles
- B. Chamber pressure
- C. Electro-mechanical
- D. Volumetric positive displacement
- E. Reverse direction
- F. None of the Above

400. The third type of diaphragm pump has one or more springs with the fluid to be pumped on both sides.

- A. True
- B. False