

**Registration Form**

**Water Treatment System Survey CEU Training Course \$300.00  
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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**Operator ID #** \_\_\_\_\_ **Exp Date** \_\_\_\_\_

*Your certificate will be mailed to you in about two weeks.*

**Please circle/check which certification you are applying the course CEU's.**  
Water Treatment \_\_\_ Water Distribution \_\_\_ Other \_\_\_\_\_

**Technical Learning College**  
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Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)  
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**Invoice me, PO #** \_\_\_\_\_

***We will stop mailing the certificate of completion so we need your e-mail address.***

## **DISCLAIMER NOTICE**

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

State Approval Listing Link, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. If the course is not accepted for CEU credit, we will give you the course free if you ask your State to accept it for credit.

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

## **State Approval Listing URL...**

<http://www.tlch2o.com/PDF/CEU%20State%20Approvals.pdf>

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

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

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.

Thank you...

# Water Treatment System Survey Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

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

- |                 |                 |                  |
|-----------------|-----------------|------------------|
| 1. A B C D E F  | 43. A B C D E F | 85. A B C D E F  |
| 2. A B C D E F  | 44. A B C D E F | 86. A B C D E F  |
| 3. A B C D E F  | 45. A B C D E F | 87. A B C D E F  |
| 4. A B C D E F  | 46. A B C D E F | 88. A B C D E F  |
| 5. A B C D E F  | 47. A B C D E F | 89. A B C D E F  |
| 6. A B C D E F  | 48. A B C D E F | 90. A B C D E F  |
| 7. A B C D E F  | 49. A B C D E F | 91. A B C D E F  |
| 8. A B C D E F  | 50. A B C D E F | 92. A B C D E F  |
| 9. A B C D E F  | 51. A B C D E F | 93. A B C D E F  |
| 10. A B C D E F | 52. A B C D E F | 94. A B C D E F  |
| 11. A B C D E F | 53. A B C D E F | 95. A B C D E F  |
| 12. A B C D E F | 54. A B C D E F | 96. A B C D E F  |
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| 14. A B C D E F | 56. A B C D E F | 98. A B C D E F  |
| 15. A B C D E F | 57. A B C D E F | 99. A B C D E F  |
| 16. A B C D E F | 58. A B C D E F | 100. A B C D E F |
| 17. A B C D E F | 59. A B C D E F | 101. A B C D E F |
| 18. A B C D E F | 60. A B C D E F | 102. A B C D E F |
| 19. A B C D E F | 61. A B C D E F | 103. A B C D E F |
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| 21. A B C D E F | 63. A B C D E F | 105. A B C D E F |
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| 320. A B C D E F | 361. A B C D E F |                  |

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

**Rush Grading Service**

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

**WATER TREATMENT SYSTEM SURVEY CEU TRAINING COURSE  
CUSTOMER SERVICE RESPONSE CARD**

NAME: \_\_\_\_\_

E-MAIL \_\_\_\_\_ PHONE \_\_\_\_\_

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

1. Please rate the difficulty of your course.  
Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.  
Very Easy 0 1 2 3 4 5 Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.  
Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course? \_\_\_\_\_

5. What would you do to improve the Course?

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How about the price of the course?

Poor \_\_\_\_\_ Fair \_\_\_\_\_ Average \_\_\_\_\_ Good \_\_\_\_\_ Great \_\_\_\_\_

How was your customer service?

Poor \_\_\_\_\_ Fair \_\_\_\_\_ Average \_\_\_\_\_ Good \_\_\_\_\_ Great \_\_\_\_\_

Any other concerns or comments.

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# WATER TREATMENT SYSTEM SURVEY CEU TRAINING COURSE ASSIGNMENT

You will have 90 days from receipt of this manual to complete it in order to receive your Professional Development Hours (PDHs) or Continuing Education Unit (CEU). A score of 70 % or better is necessary to pass this course. Use the search key or find in Adobe Acrobat if you cannot find the answer. If you should need any assistance, please email all concerns and the completed answer key to info@tlch2o.com.

**Please use the Answer Key and Circle, Bold or X out the answer.**

Multiple Choice, pick one answer only. All answers come exactly from the text.

## Diatomaceous Earth Filter

1. This type of filter is commonly used for the \_\_\_\_\_. The process was developed by the military during World War II to remove microorganisms that cause amoebic dysentery from water used in the field.

- A. Raw-water turbidity
- B. Lower capital cost
- C. Microorganism removal
- D. Increasing of plant capacity
- E. All of the Above
- F. None of the above

## Filtration Processes

2. Two basic types of filtration processes are currently used in the United States. Conventional filtration, the traditional design for many years, provides effective treatment for just about any range of \_\_\_\_\_.

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

3. Its success is due partially to the sedimentation that precedes filtration and follows the coagulation and flocculation steps. \_\_\_\_\_, if operated properly, should remove most of the suspended material.

- A. Raw-water turbidity
- B. Lower capital cost
- C. Microorganism removal
- D. Increasing plant capacity
- E. All of the Above
- F. None of the above

4. After sedimentation, the water passing through to the filters should not have turbidity higher than 10-to-15 NTU. Rapid sand filters were once used in the conventional process, but many have been converted 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

There are no intentional trick questions

5. In the other type of filtration process--direct filtration--no sedimentation follows the coagulation phase. Direct filtration is designed to filter water with a(n) \_\_\_\_\_ of less than 25 NTU.

- A. Average turbidity
- B. Lower capital cost
- C. Microorganism removal
- D. Nominal turbidity
- E. All of the Above
- F. None of the Above

6. Dual and multi-media filters are used with \_\_\_\_\_. They are able to remove more suspended material per cubic foot of filter media than sand filters. Direct filtration plants have a lower capital cost. The process cannot handle large variations in raw water turbidity.

- A. Long filter run
- B. Filtering to waste controls
- C. Flow tube controller
- D. Direct filtration
- E. All of the Above
- F. None of the Above

#### High Rate Filters

7. 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

8. The combinations vary with \_\_\_\_\_. Multi-media or mixed-media filters use three or four different materials, generally sand, anthracite coal, and garnet.

- A. The finer material farther down
- B. The top of the sand layer with larger grains
- C. Larger suspended particles
- D. Application, but generally they are sand and anthracite coal
- E. All of the Above
- F. None of the Above

9. In rapid sand filters, finer sand grains are at the \_\_\_\_\_ farther down into the filter.

- 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. All of the Above
- F. None of the Above

10. The filter removes more suspended material in the first few inches of the filter. In 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. All of the Above
- F. None of the Above

11. The top layers consist of a coarse material with the \_\_\_\_\_, allowing the suspended material to penetrate deeper into the filter.

- A. Finer material farther down
- B. Top of the sand layer with larger grains
- C. Larger suspended particles are removed first
- D. The media size increases
- E. All of the Above
- F. None of the Above

12. The material in a filter bed forms layers in the filter, depending on their weight and specific gravities. In the coarse layer at the top, the \_\_\_\_\_, followed by the finer materials. This allows for longer filter runs at higher rates than is possible with rapid sand filters.

- A. Media size increases
- B. Top of the sand layer with larger grains
- C. Larger suspended particles are removed first
- D. Media size decreases
- E. All of the Above
- F. None of the Above

13. The type of filter media used in a high rate filter depends on many factors, including the raw-water quality, \_\_\_\_\_, and the chemical treatment used.

- A. Finer material
- B. Raw-water variations
- C. Media size
- D. Rapid sand filters
- E. All of the Above
- F. None of the Above

14. Pilot studies help the operator \_\_\_\_\_, or combination of materials, will give the best result.

- A. Improve engineers' welfare
- B. Assist outside contractors
- C. Perform operations
- D. Evaluate which material
- E. All of the Above
- F. None of the Above

#### Pressure Sand Filters

15. This type of filter is used extensively in iron and manganese \_\_\_\_\_.

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

16. A \_\_\_\_\_ is contained under pressure in a steel tank, which may be vertical or horizontal, depending on the space available.

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

17. As with \_\_\_\_\_, the media is usually sand or a combination of media. Filtration rates are similar to gravity filters.

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

18. These filters are commonly used for iron and manganese removal from groundwater, which is first aerated to oxidize the iron or manganese present, then pumped through the filter to remove the \_\_\_\_\_.

- A. Suspended material
- B. Bacteria
- C. Solids
- D. Fish
- E. All of the Above
- F. None of the Above

19. Because the water is under \_\_\_\_\_, air binding will not occur in the filter.

- A. Gravity
- B. Velocity
- C. Pressure
- D. Ground
- E. All of the Above
- F. None of the Above

20. \_\_\_\_\_ have a major disadvantage in that the backwash cannot be observed; in addition, cracking of the filter bed can occur quite easily, allowing the iron and manganese particles to go straight through the filter.

- A. RO
- B. Pressure filters
- C. Pressure sand filter
- D. Filter effluent
- E. All of the Above
- F. None of the Above

21. When using pressure filters for iron and manganese removal, the operator must regularly measure the iron and manganese concentration of the filter effluent and backwash the filter before breakthrough occurs. Because of these limitations, \_\_\_\_\_ must not be used to treat surface water.

- A. Suspended material
- B. Pressure filters
- C. Pressure sand filter
- D. Filter effluent
- E. All of the Above
- F. None of the Above

#### Filtration Operation

22. Filtration operation is divided into three steps: filtering, backwashing, and \_\_\_\_\_.

- A. Filter run
- B. Filtering to waste
- C. Return to waste
- D. Drying
- E. None of the Above

Declining Rate

23. This method of control is used where the head loss through the plant is quite large. It allows the filter head to increase until the filter becomes plugged with particles and the \_\_\_\_\_ is too great to continue operation of the filter.

- A. Filter run
- B. Mudballs
- C. Water
- D. Head loss
- E. All of the Above
- F. None of the Above

24. The rate through the filter is much greater in the beginning of a filter run than at the end when the \_\_\_\_\_. This method tends to be the most commonly installed in new filter plants.

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

Safe Drinking Water Act Terms

25. 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
- B. At least 15
- C. 1,000
- D. Within 30
- E. All of the Above
- F. None of the Above

26. Class V Underground Injection Control (UIC) rule under development \_\_\_\_\_ not included in Class I, II, III or IV in which nonhazardous fluids are injected into or above underground sources of drinking water.

- A. Alternative monitoring
- B. Covering wells
- C. When contaminants are detected
- D. Reasonably available
- E. All of the Above
- F. None of the Above

27. \_\_\_\_\_ is the process of identifying and inventorying contaminant sources within delineated source water protection areas through recording existing data, describing sources within the source water protection area, targeting likely sources for further investigation, collecting and interpreting new information on existing or potential sources through surveys, and verifying accuracy and reliability of the information gathered.

- A. Drinking Water State Revolving Fund
- B. Contamination Source Inventory
- C. Class V Underground Injection Control
- D. Sole Source Aquifer
- E. All of the Above
- F. None of the Above

28. \_\_\_\_\_ is protozoan associated with the disease cryptosporidiosis in humans. The disease can be transmitted through ingestion of drinking water, person-to-person contact, or other exposure routes.

- A. Giardia lamblia
- B. Virus
- C. Cryptosporidium
- D. All of the Above
- E. None of the above

29. \_\_\_\_\_ is under section 1452 of the SDWA, the EPA awards capitalization grants to states to develop drinking water revolving loan funds to help finance drinking water system infrastructure improvements, source water protection, to enhance operations and management of drinking water systems, and other activities to encourage public water system compliance and protection of public health.

- A. Drinking Water State Revolving Fund
- B. Contamination Source Inventory
- C. Class V Underground Injection Control
- D. Sole Source Aquifer
- E. All of the Above
- F. None of the Above

30. \_\_\_\_\_ is a protozoan, which can survive in water for 1 to 3 months, associated with the disease giardiasis.

- A. Giardia lamblia
- B. Virus
- C. Cryptosporidium
- D. Gastrointestinal bug
- E. All of the Above
- F. None of the Above

31. The symptoms of this \_\_\_\_\_ disease may persist for weeks or months and include diarrhea, fatigue, and cramps.

- A. Giardia lamblia
- B. Virus
- C. Cryptosporidium
- D. Gastrointestinal
- E. All of the Above
- F. None of the Above

32. \_\_\_\_\_ is under section 107 of the SDWA Amendments of 1996, the statute reads, ". . . the Administrator shall also promulgate national primary drinking water regulations requiring disinfection as a treatment technique for all public water systems, including surface water systems, and as necessary, ground water systems."

- A. Ground Water Disinfection Rule
- B. Maximum Contaminant Level
- C. Maximum Contaminant Level Goal
- D. The Safe Drinking Water Act
- E. All of the Above
- F. None of the Above

33. In the SDWA, a(n) \_\_\_\_\_ is defined as "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system." MCLs are enforceable standards.
- A. Ground Water Disinfection Rule
  - B. Maximum Contaminant Level
  - C. Maximum Contaminant Level Goal
  - D. The Safe Drinking Water Act
  - E. All of the Above
  - F. None of the Above
34. \_\_\_\_\_ is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health effect of persons would occur, and which allows for an adequate margin of safety.
- A. Ground Water Disinfection Rule
  - B. Maximum Contaminant Level
  - C. Maximum Contaminant Level Goal
  - D. The Safe Drinking Water Act
  - E. All of the Above
  - F. None of the Above
35. \_\_\_\_\_ is a unit of measure used to describe the turbidity of water. Turbidity is the cloudiness in water.
- A. Jackson unit
  - B. Secchi disk machine SDM
  - C. Cloudy water unit
  - D. Nephelometric Turbidity Unit
  - E. All of the Above
  - F. None of the Above
36. \_\_\_\_\_ in drinking water are associated with methemoglobinemia, or blue baby syndrome, which results from interferences in the blood's ability to carry oxygen.
- A. Inorganic compounds
  - B. Nitrates
  - C. Organics
  - D. Radionuclides
  - E. All of the Above
  - F. None of the Above
37. \_\_\_\_\_ contaminants of concern to drinking water include chlorohydrocarbons, pesticides, and others.
- A. Inorganic compounds
  - B. Nitrates
  - C. Organic
  - D. Radionuclides
  - E. All of the Above
  - F. None of the Above
38. Phase I Contaminants. The Phase I Rule became effective on January 9, 1989. This rule, also called the \_\_\_\_\_, set water quality standards for 8 VOCs and required all community and Non-Transient, Non-Community water systems to monitor for, and if necessary, treat their supplies for these chemicals.
- A. Surface Water Treatment Rule
  - B. Volatile Organic Chemical Rule
  - C. Volatile Inorganic Chemical Rule
  - D. Clean Water Act
  - E. None of the Above

39. The 8 VOCs regulated under this rule are: Benzene, \_\_\_\_\_, para-dichlorobenzene, trichloroethylene, vinyl chloride, 1,1,2-trichloroethane, 1,1-dichloroethylene, and 1,2-dichloroethane.
- A. Inorganic compounds
  - B. Nitrates
  - C. Carbon Tetrachloride
  - D. Radionuclides
  - E. All of the Above
  - F. None of the Above
40. \_\_\_\_\_; generally used in expressions of water use, gallons per capita per day (gpcd).
- A. One person per day
  - B. Per capita Per person
  - C. Per day per person
  - D. All of the Above
  - E. None of the above
41. \_\_\_\_\_ Water Treatment. Refers to devices used in the home or office on a specific tap to provide additional drinking water treatment.
- A. Point-of-Use
  - B. Per capita
  - C. Point-of-Entry
  - D. Sole Source Aquifer
  - E. All of the Above
  - F. None of the Above
42. \_\_\_\_\_ Water Treatment. Refers to devices used in the home where water pipes enter to provide additional treatment of drinking water used throughout the home.
- A. Point-of-Use
  - B. Sand
  - C. Point-of-Entry
  - D. RO
  - E. All of the Above
  - F. None of the Above
43. \_\_\_\_\_ has adopted rules at least as stringent as federal regulations and has been granted primary enforcement responsibility.
- A. Federal government
  - B. NRWA
  - C. State
  - D. EPA
  - E. All of the Above
  - F. None of the Above
44. \_\_\_\_\_ are elements that undergo a process of natural decay. As radionuclides decay, they emit radiation in the form of alpha or beta particles and gamma photons.
- A. Inorganic compounds
  - B. Nitrates
  - C. Organics
  - D. Radionuclides
  - E. All of the Above
  - F. None of the Above

45. \_\_\_\_\_ can cause adverse health effects, such as cancer, so limits are placed on radionuclide concentrations in drinking water.
- A. Inorganic compounds
  - B. Nitrates
  - C. Radiation
  - D. Organics
  - E. All of the Above
  - F. None of the Above
46. \_\_\_\_\_ was first passed in 1974 and established the basic requirements under which the nation's public water supplies were regulated.
- A. Surface Water Treatment Rule
  - B. The Safe Drinking Water Act
  - C. Volatile Inorganic Chemical Rule
  - D. Clean Water Act
  - E. All of the Above
  - F. None of the Above
47. The US Environmental Protection Agency (EPA) is responsible for setting the national drinking water regulations, while individual states are responsible for ensuring that public water systems under their jurisdiction are complying with the regulations. The \_\_\_\_\_ was amended in 1986 and again in 1996.
- A. Surface Water Treatment Rule
  - B. The Safe Drinking Water Act
  - C. Volatile Inorganic Chemical Rule
  - D. Clean Water Act
  - E. All of the Above
  - F. None of the Above
48. \_\_\_\_\_ is a facility or activity that stores, uses, or produces chemicals or elements, and that has the potential to release contaminants identified in a state program (contaminants with MCLs plus any others a state considers a health threat) within a source water protection area in an amount which could contribute significantly to the concentration of the contaminants in the source waters of the public water supply.
- A. Drinking Water State Revolving Fund
  - B. Significant Potential Source of Contamination
  - C. Class V Underground Injection Control
  - D. Sole Source Aquifer
  - E. All of the Above
  - F. None of the Above
49. \_\_\_\_\_ Designation is the surface area above a sole source aquifer and its recharge area.
- A. Karst
  - B. Confined
  - C. Point-of-Entry
  - D. Sole Source Aquifer
  - E. All of the Above
  - F. None of the Above

50. \_\_\_\_\_ is the area delineated by the state for a PWS or including numerous PWSs, whether the source is ground water or surface water or both, as part of the state SWAP approved by the EPA under section 1453 of the SDWA.

- A. Source Water Protection Area
- B. Confined aquifer
- C. Unconfined aquifer
- D. Sole Source Aquifer
- E. All of the Above
- F. None of the Above

51. \_\_\_\_\_ is a topographic boundary that is the perimeter of the catchment area of a tributary of a stream.

- A. Source Water Protection Area
- B. Sub-watershed
- C. Confined aquifer
- D. Unconfined aquifer
- E. All of the Above
- F. None of the Above

52. \_\_\_\_\_ is a state program implemented in accordance with the statutory language at section 1454 of the SDWA to establish local voluntary incentive-based partnerships for SWP and remediation.

- A. Drinking Water State Revolving Fund
- B. Contamination Source Inventory
- C. Class V Underground Injection Control
- D. State Source Water Petition Program
- E. All of the Above
- F. None of the Above

53. State Management Plan (SMP) Program. A state management plan under FIFRA required by the EPA to allow states (e.g. states, tribes and U.S. territories) the flexibility to design and implement approaches to manage the use of certain \_\_\_\_\_ to protect ground water.

- A. Inorganic compounds
- B. Nitrates
- C. Pesticides
- D. Virus
- E. All of the Above
- F. None of the Above

54. SWTR rule specifies maximum contaminant level goals for \_\_\_\_\_, viruses and Legionella, and promulgated filtration and disinfection requirements for public water systems using surface water sources, or by ground water sources under the direct influence of surface water.

- A. Giardia lamblia
- B. Inorganic compounds
- C. Nitrates
- D. Gastrointestinal diseases
- E. All of the Above
- F. None of the Above

55. The above regulations also specify water quality, treatment, and watershed protection criteria under which filtration may be avoided.

- A. Surface Water Treatment Rule
- B. The Safe Drinking Water Act
- C. Volatile Inorganic Chemical Rule
- D. Clean Water Act
- E. None of the Above

56. \_\_\_\_\_ is used to determine, with a clear understanding of where the significant potential sources of contamination are located, the susceptibility of the public water systems in the source water protection area to contamination from these sources.
- A. Source Water Protection Area surveys
  - B. Sub-watershed analysis
  - C. Susceptibility Analysis
  - D. Inspection
  - E. All of the Above
  - F. None of the Above
57. States must inventory sources of contamination to the extent they have the technology and resources to complete an inventory for a \_\_\_\_\_ delineated as described in the guidance.
- A. Source Water Protection Area
  - B. Sub-watershed area
  - C. Confined aquifer
  - D. Unconfined aquifer
  - E. All of the Above
  - F. None of the Above
58. This system serves 25 non-resident persons per day for 6 months or less per year.
- A. Transient/Non-Transient, Community Water System
  - B. Transient/Non-Transient, Non-Community Water Systems
  - C. Public Water System Transient/Non-Transient,
  - D. Transient/Non-Transient, Private Water System
  - E. All of the Above
  - F. None of the Above
59. This system serve at least 25 of the same non-resident persons per day for more than 6 months per year.
- A. Community Water System
  - B. Non-Community Water Systems
  - C. Public Water System Transient/Non-Transient,
  - D. Private Water System
  - E. All of the Above
  - F. None of the Above
60. A specific treatment method required by the EPA to be used to control the level of a contaminant in drinking water.
- A. Ozone
  - B. RO
  - C. Treatment technique
  - D. Slow sand
  - E. All of the Above
  - F. None of the Above
61. A treatment technique is a(n) \_\_\_\_\_ procedure or level of technical performance which public water systems must follow to ensure control of a contaminant.
- A. Civil action
  - B. Non-enforceable
  - C. Enforceable
  - D. Feasible
  - E. All of the Above
  - F. None of the Above

62. Bacteria that are used as indicators of \_\_\_\_\_ in drinking water.
- A. Giardia lamblia
  - B. Total Coliform
  - C. Cryptosporidium
  - D. Fecal contaminants
  - E. All of the Above
  - F. None of the Above
63. \_\_\_\_\_ is the property of a chemical to harm people who come into contact with it.
- A. Inorganic compound
  - B. Odoriferous
  - C. Toxicity
  - D. Dangerous
  - E. All of the Above
  - F. None of the Above
64. Underground Injection Control (UIC) Program. The program is designed to prevent underground injection which endangers drinking water sources. The program applies to \_\_\_\_\_ and operators on Federal facilities, Native American lands, and on all U.S. land and territories.
- A. Wellhead Protection Area
  - B. Treatment Technique
  - C. Contamination Source Inventory
  - D. Injection well owners
  - E. All of the Above
  - F. None of the Above
65. \_\_\_\_\_ is a topographic boundary area that is the perimeter of the catchment area of a stream.
- A. Wellhead Protection Area
  - B. Watershed
  - C. Contamination Source area
  - D. Drawdown
  - E. All of the Above
  - F. None of the Above
66. \_\_\_\_\_ is a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow.
- A. Wellhead Protection Area
  - B. Treatment Technique
  - C. Contamination Source Inventory
  - D. Watershed Approach
  - E. All of the Above
  - F. None of the Above
67. \_\_\_\_\_ is a topographic area that is within a line drawn connecting the highest points uphill of a drinking water intake, from which overland flow drains to the intake.
- A. Wellhead Protection Area
  - B. Treatment Technique
  - C. Watershed Area
  - D. Injection well owners
  - E. All of the Above
  - F. None of the Above

68. The surface and subsurface area surrounding a well or well field, supplying a PWS, through which contaminants are reasonably likely to move toward and reach such water well or well field.

- A. Wellhead Protection Area
- B. Treatment Technique
- C. Contamination Source Inventory
- D. Injection well owners
- E. All of the Above
- F. None of the Above

69. EPA is directed to conduct drinking water studies involving subpopulations at greater risk and biological mechanisms, and studies to support several rules including those addressing D/DBPs and \_\_\_\_\_.

- A. Global warming
- B. Population control
- C. Pharmaceuticals
- D. Cryptosporidium
- E. All of the Above
- F. None of the Above

#### SDWA Water Quality Information and MCLs

70. Certain minerals are \_\_\_\_\_ and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of EPA standards over many years may have an increased risk of getting cancer.

- A. Inorganic radiation
- B. Nitrates
- C. Organics
- D. Radioactive
- E. All of the Above
- F. None of the Above

71. Certain minerals are radioactive and may emit forms of radiation known as photons and \_\_\_\_\_.

- A. Inorganic radiation
- B. Beta radiation
- C. Organics
- D. Radioactive
- E. All of the Above
- F. None of the Above

72. Some people who drink water containing beta and photon emitters in excess of EPA standards over many years may have an increased risk of getting \_\_\_\_\_.

- A. Colitis
- B. Cancer
- C. Acute radon
- D. Poisoning
- E. All of the Above
- F. None of the Above

73. Some people who drink water containing \_\_\_\_\_ in excess of EPA standards over many years may have an increased risk of getting cancer.

- A. Inorganic radiation
- B. Beta radiation
- C. Radium 226 or 228
- D. Radioactive
- E. All of the Above
- F. None of the Above

74. \_\_\_\_\_ gas can dissolve and accumulate in underground water sources, such as wells, and in the air in your home. Breathing radon can cause lung cancer.
- A. Radon
  - B. Beta radiation
  - C. Organics
  - D. Radioactive
  - E. All of the Above
  - F. None of the Above

#### Inorganic Contaminants

75. Some people who drink water containing \_\_\_\_\_ in excess of EPA standards over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.

- A. Inorganic compounds
- B. Nitrates
- C. Arsenic
- D. Fluoride
- E. All of the Above
- F. None of the Above

76. Each community makes its own decision about whether or not to add \_\_\_\_\_.

- A. Inorganic compounds
- B. Nitrates
- C. Arsenic
- D. Fluoride
- E. All of the Above
- F. None of the Above

77. The EPA has set an enforceable drinking water standard for fluoride of \_\_\_\_\_ (some people who drink water containing fluoride in excess of this level over many years could get bone disease, including pain and tenderness of the bones).

- A. 4 mg/L
- B. 2 mg/L
- C. 50 parts per billion
- D. 100 parts per billion
- E. A and C
- F. None of the Above

78. The EPA has also set a secondary fluoride standard of \_\_\_\_\_ to protect against dental fluorosis.

- A. 4 mg/L
- B. 2 mg/L
- C. 50 parts per billion
- D. 100 parts per billion
- E. A and C
- F. None of the Above

79. Dental fluorosis, in its moderate or severe forms, may result in a brown staining and/or pitting of the permanent teeth. This problem occurs only in developing teeth, before they erupt from the gums. Children under nine should not drink water that has more than \_\_\_\_\_ of fluoride.

- A. 4 mg/L
- B. 2 mg/L
- C. 50 parts per billion
- D. A and C
- E. None of the above

80. \_\_\_\_\_ pipes and plumbing fittings have been banned since August 1998.
- A. Copper
  - B. Concrete
  - C. Plastic
  - D. Lead
  - E. A and C
  - F. None of the Above

New EPA Water Rules

81. \_\_\_\_\_ is a chemical that occurs naturally in the earth's crust.
- A. Inorganic compounds
  - B. Nitrates
  - C. Arsenic
  - D. Radionuclides
  - E. A and C
  - F. None of the Above

82. When people either drink this water or eat animals and plants that drink it, they are exposed to arsenic. In the U.S., eating and drinking are the most common ways that people are exposed to arsenic, although it can also come from industrial sources. Studies have linked long-term exposure of arsenic in drinking water to a variety of \_\_\_\_\_ in humans.
- A. Colitis
  - B. Cancer
  - C. Acute radon
  - D. Poisoning
  - E. A and C
  - F. None of the Above

83. To protect human health, an EPA standard limits the amount of arsenic in drinking water. Back in January 2001, the EPA revised the standard from 50 parts per billion (ppb), ordering that it fall to \_\_\_\_\_ by 2006.
- A. 4 mg/L
  - B. 10 ppb
  - C. 50 parts per billion
  - D. 100 parts per billion
  - E. A and C
  - F. None of the Above

84. After adopting \_\_\_\_\_ as the new standard for arsenic in drinking water, the EPA decided to review the decision to ensure that the final standard was based on sound science and accurate estimates of costs and benefits. In October 2001, the EPA decided to move forward with implementing the 10ppb standard for arsenic in drinking water.
- A. 10 ppb
  - B. 2 mg/L
  - C. 50 parts per billion
  - D. 100 parts per billion
  - E. A and C
  - F. None of the Above

ICR Information Collection Rule

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

- A. Disinfection byproducts
- B. Inorganics
- C. Turbidity
- D. Pesticides
- E. A and C
- F. None of the Above

86. The ICR rule is intended to provide the 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 \_\_\_\_\_, including Cryptosporidium; and engineering data to control these contaminants.

- A. Disinfection byproducts
- B. Inorganics
- C. Microorganisms
- D. Pesticides
- E. A and C
- F. None of the Above

87. Currently trihalomethanes are regulated at a maximum allowable annual average level of \_\_\_\_\_ for water systems serving over 10,000 people under the Total Trihalomethane Rule finalized by the EPA in 1979.

- A. 4 mg/L
- B. 2 mg/L
- C. 50 parts per billion
- D. 100 parts per billion
- E. A and C
- F. None of the Above

88. The Stage 1 Disinfectant/Disinfection Byproduct Rule standards became effective for trihalomethanes and other disinfection byproducts listed above in December 2001 for \_\_\_\_\_ surface water public water systems.

- A. Small
- B. Large
- C. Medium
- D. Private
- E. A and C
- F. None of the Above

89. Disinfection byproducts are formed when disinfectants used in water treatment plants react with \_\_\_\_\_ and/or natural organic matter (i.e., decaying vegetation) present in the source water. Different disinfectants produce different types or amounts of disinfection byproducts.

- A. Bromate
- B. Monochloramine
- C. Chloroform
- D. Bromide
- E. A and C
- F. None of the Above

90. Disinfection byproducts for which regulations have been established have been identified in drinking water, including trihalomethanes, haloacetic acids, \_\_\_\_\_, and chlorite.

- A. Bromate
- B. Monochloramine
- C. Chloroform
- D. Dichloramine
- E. A and C
- F. None of the Above

91. Trihalomethanes (THM) are a group of four chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring \_\_\_\_\_ and inorganic matter in water.

- A. Oxygen
- B. Solids
- C. Turbidity
- D. Organics
- E. A and C
- F. None of the Above

92. The trihalomethanes are \_\_\_\_\_, bromodichloromethane, dibromochloromethane, and bromoform.

- A. Bromine
- B. Monochloramine
- C. Chloroform
- D. Dichloramine
- E. A and C
- F. None of the Above

93. The EPA has published the Stage 1 Disinfectants/Disinfection Byproducts Rule to regulate total trihalomethanes (TTHM) at a maximum allowable annual average level of \_\_\_\_\_.

- A. 4 mg/L
- B. 2 mg/L
- C. 80 parts per billion
- D. 100 parts per billion
- E. A and C
- F. None of the Above

94. Haloacetic Acids (HAA5) are a group of chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring \_\_\_\_\_ and inorganic matter in water.

- A. Acid
- B. Solid
- C. Material
- D. Organics
- E. A and C
- F. None of the Above

95. The regulated haloacetic acids, known as HAA5, are: \_\_\_\_\_, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.

- A. Bromine acids
- B. Monochloramine acids
- C. Monochloroacetic acid
- D. Dichloramine acids
- E. A and C
- F. None of the Above

96. The EPA has published the Stage 1 Disinfectants/Disinfection Byproducts Rule to regulate HAA5 at \_\_\_\_\_ annual average.

- A. 4 mg/L
- B. 2 mg/L
- C. 60 parts per billion
- D. 100 parts per billion
- E. A and C
- F. None of the Above

97. Bromate is a chemical that is formed when ozone used to disinfect drinking water reacts with naturally occurring bromide found in source water. The EPA has established the Stage 1 Disinfectants/Disinfection Byproducts Rule to regulate bromate at annual average of \_\_\_\_\_ in drinking water.

- A. 4 mg/L
- B. 2 mg/L
- C. 50 parts per billion
- D. 10 parts per billion
- E. A and C
- F. None of the Above

98. Chlorite is a byproduct formed when chlorine dioxide is used to disinfect water. The EPA has published the Stage 1 Disinfectants/Disinfection Byproducts Rule to regulate chlorite at a monthly average level of \_\_\_\_\_ in drinking water.

- A. 4 mg/L
- B. 2 mg/L
- C. 50 parts per billion
- D. 1 parts per million
- E. A and C
- F. None of the Above

#### Microbial Regulations

99. One of the key regulations developed and implemented by the United States Environmental Protection Agency (USEPA) to counter \_\_\_\_\_ in drinking water is the Surface Water Treatment Rule.

- A. Pathogens
- B. Organics
- C. Purification
- D. Contaminants
- E. A and C
- F. None of the Above

100. Among its provisions, the rule requires that a public water system, using surface water (or ground water under the direct influence of surface water) as its source, have sufficient treatment to reduce the source water concentration of Giardia and \_\_\_\_\_ by at least 99.9% and 99.99%, respectively.

- A. Viruses
- B. Organics
- C. Purification
- D. Contaminants
- E. A and C
- F. None of the Above

101. The Surface Water Treatment Rule specifies treatment criteria to assure that these performance requirements are met; they include \_\_\_\_\_, disinfectant residual, and disinfectant contact time conditions.

- A. Turbidity limits
- B. Organic limits
- C. Purification
- D. Contaminants
- E. A and C
- F. None of the Above

102. The Interim Enhanced Surface Water Treatment Rule was established in December 1998 to control \_\_\_\_\_, and to maintain control of pathogens while systems lower disinfection byproduct levels to comply with the Stage 1 Disinfectants/Disinfection Byproducts Rule.

- A. Total coliform
- B. Giardia lamblia
- C. Turbidity
- D. Cryptosporidium
- E. A and C
- F. None of the Above

103. The EPA established a Maximum Contaminant Level Goal (MCLG) of zero for all public water systems and a 99% removal requirement for \_\_\_\_\_ in filtered public water systems that serve at least 10,000 people.

- A. Total coliform
- B. Giardia lamblia
- C. Turbidity
- D. Cryptosporidium
- E. A and C
- F. None of the Above

104. \_\_\_\_\_ is an indicator of the physical removal of particulates, including pathogens.

- A. Organics
- B. Turbidity
- C. Purification
- D. Contaminants
- E. A and C
- F. None of the Above

105. The EPA is also planning to develop other rules to further control pathogens. The EPA has promulgated a Long Term 1 Enhanced Surface Water Treatment Rule, for systems serving fewer than 10,000 people, to improve physical removal of \_\_\_\_\_, and to maintain control of pathogens while systems comply with Stage 1 Disinfectants/Disinfection Byproducts Rule.

- A. Cryptosporidium
- B. Organics
- C. Purification
- D. Contaminants
- E. A and C
- F. None of the Above

Microbes

106. Coliform \_\_\_\_\_ are common in the environment and are generally not harmful. However, the presence of these bacteria in drinking water are usually a result of a problem with the treatment system or the pipes which distribute water, and indicates that the water may be contaminated with germs that can cause disease.

- A. And Viruses
- B. And Organics
- C. Bacteria
- D. Contaminants
- E. B and C
- F. None of the Above

107. Fecal Coliform and E. coli are \_\_\_\_\_ whose presence indicates that the water may be contaminated with human or animal wastes.

- A. Viruses
- B. Organics
- C. Bacteria
- D. Contaminants
- E. B and C
- F. None of the Above

108. Microbes in these wastes can cause short-term effects, such as \_\_\_\_\_, cramps, nausea, headaches, or other symptoms.

- A. Diarrhea
- B. Cryptosporidiosis
- C. Depression
- D. Loss of sight
- E. B and C
- F. None of the Above

109. Cryptosporidium is a parasite that enters lakes and rivers through sewage and animal waste. It causes \_\_\_\_\_, a mild gastrointestinal disease.

- A. Diarrhea
- B. Cryptosporidiosis
- C. Depression
- D. Loss of sight
- E. B and C
- F. None of the Above

110. The disease can be severe or \_\_\_\_\_ for people with severely weakened immune systems. The EPA and CDC have prepared advice for those with severely compromised immune systems who are concerned about Cryptosporidium.

- A. Chronic
- B. Acute
- C. Cancerous
- D. Fatal
- E. B and C
- F. None of the Above

111. Giardia lamblia is a parasite that enters lakes and rivers through sewage and animal waste. It causes \_\_\_\_\_ (e.g. diarrhea, vomiting, and cramps).

- A. Gastrointestinal illness
- B. Cryptosporidiosis
- C. Depression
- D. Loss of touch
- E. None of the Above

112. \_\_\_\_\_ is manufactured from aluminum hydroxide by dehydroxylating it in a way that produces a highly porous material; this material can have a surface area significantly over 200 square meters/g.

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

113. This compound is used as a desiccant (to keep things dry by absorbing water from the air) and as a filter of \_\_\_\_\_, arsenic and selenium in drinking water.

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

114. This compound is made of \_\_\_\_\_ (alumina;  $Al_2O_3$ ), the same chemical substance as sapphire and rubies (but without the impurities that give those gems their color).

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

115. \_\_\_\_\_ is also called activated charcoal or activated coal, is a form of carbon that 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
- B. GOC
- C. Activated carbon
- D. Organic carbon
- E. B and C
- F. None of the Above

116. Due to its high degree of microporosity, just one gram of \_\_\_\_\_ has a surface area of approximately 500 m<sup>2</sup>, as determined typically by nitrogen gas adsorption.

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

117. Sufficient activation for useful applications may come solely from the high surface area, though further chemical treatment often enhances the adsorbing properties of the material.

\_\_\_\_\_ is usually derived from charcoal.

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

118. \_\_\_\_\_ is a broad classification for organic molecules of varied origin and composition within aquatic systems.

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

119. The "dissolved" fraction of \_\_\_\_\_ is an operational classification. Many researchers place the dissolved/colloidal cutoff at 0.45 micrometers, but 0.22 micrometers is also typical.

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

120. EDTA is a widely used abbreviation for the chemical compound \_\_\_\_\_.

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

121. \_\_\_\_\_ refers to the chelating agent with the formula  $(\text{HO}_2\text{CCH}_2)_2\text{NCH}_2\text{CH}_2\text{N}(\text{CH}_2\text{CO}_2\text{H})_2$ . This amino acid is widely used to sequester di- and trivalent metal ions ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  for example).

- A. EDTA
- B. Fluoride
- C. Activated carbon
- D. Dissolved organic carbon
- E. B and C
- F. None of the Above

122. \_\_\_\_\_ forms especially strong complexes with Mn(II), Cu(II), Fe(III), Pb (II) and Co(III).

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

123. \_\_\_\_\_ recovery is an improved method and apparatus for recovering metal values from Electric Arc Furnace dust, particularly zinc and iron values, by mixing EAF dust and carbonaceous fines to form a particulate mixture; heating the mixture at a sufficient temperature and for a sufficient time to reduce and release volatile metals and alkali metals in a flue gas; collecting the released metals, and removing the metal values from the process as product.

- A. Nanofiltration
- B. High temperature metals
- C. Microfiltration
- D. Dissolved organic carbon
- E. None of the Above

124. \_\_\_\_\_ 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. B and C
- F. None of the Above

125. \_\_\_\_\_ is a relatively recent membrane process used most often with low total dissolved solids water such as surface water and fresh groundwater, with the purpose of softening (polyvalent cation removal) and removal of disinfection by-product precursors such as natural organic matter and synthetic organic matter.

- A. Nanofiltration
- B. Semi-permeable
- C. Microfiltration
- D. Dissolved organic carbon
- E. B and C
- F. None of the Above

126. Safe Drinking Water Act (SDWA)

The major elements of Safe Drinking Water Act include: The law updates \_\_\_\_\_ process by focusing regulations on contaminants known to pose greater public health risks.

- A. The standard-setting
- B. Every three years
- C. At least five new candidate
- D. Levels of regulated contaminants
- E. B and C
- F. None of the Above

127. It replaces the current law's demand for 25 new standards \_\_\_\_\_ with a new process based on occurrence, relative risk and cost-benefit considerations.

- A. The standard-setting
- B. Every three years
- C. At least five new candidate
- D. Levels of regulated contaminants
- E. B and C
- F. None of the Above

128. It also requires the EPA to select \_\_\_\_\_ contaminants to consider for regulation every five years.

- A. The standard-setting
- B. Every three years
- C. At least five new candidate
- D. Levels of regulated contaminants
- E. B and C
- F. None of the Above

129. The EPA is directed to require public water systems to provide customers with annual \_\_\_\_\_ in newspapers and by direct mail.

- A. The standard-setting
- B. Consumer Confidence Reports
- C. Health concerns
- D. Maximum Contaminant Levels
- E. B and C
- F. None of the Above

130. The reports must list levels of regulated contaminants along with \_\_\_\_\_ (MCLs) and Maximum Contaminant Level Goals (MCLGs), along with plainly worded definitions of both.

- A. The standard-setting of
- B. Consumer Confidence Reports and
- C. Minimum Containment Level
- D. Maximum Contaminant Levels
- E. B and C
- F. None of the Above

131. The reports must also include a plainly worded statement of the \_\_\_\_\_ for any contaminants for which there has been a violation, describe the utility's sources of drinking water and provide data on unregulated contaminants for which monitoring is required, including Cryptosporidium and radon.

- A. The standard-setting
- B. Consumer Confidence Reports
- C. Health concerns
- D. Maximum Contaminant Levels
- E. B and C
- F. None of the Above

132. Although the EPA will continue to provide policy, regulations and guidance, state governments will now have more \_\_\_\_\_ allowing for improved communication between water providers and their local regulators.

- A. Standard-setting
- B. Consumer Confidence Reports
- C. Regulatory flexibility
- D. Maximum Contaminant Levels
- E. B and C
- F. None of the Above

133. States that have a source water assessment program may adopt alternative monitoring requirements to provide \_\_\_\_\_ for public water systems in accordance with EPA guidance.

- A. Standard-setting
- B. Permanent monitoring relief
- C. At least five new candidate
- D. Levels of regulated contaminants
- E. B and C
- F. None of the Above

134. This is the primary Federal legislation protecting drinking water supplied by \_\_\_\_\_ (those serving more than 25 people).

- A. Public water systems
- B. Consumer Confidence Reports
- C. Health concerns
- D. Maximum Contaminant Levels
- E. B and C
- F. None of the Above

135. The \_\_\_\_\_ is the lead agency and is mandated to set standards for drinking water.

- A. Federal government
- B. NRWA
- C. State official
- D. EPA
- E. None of the Above

Water Treatment Section

136. The treatment needs of a water system are likely to differ depending on whether the system uses a \_\_\_\_\_ or surface water source.

- A. Groundwater
- B. Tap water
- C. Bottled water
- D. Purchased water
- E. B and C
- F. None of the Above

137. Common surface water contaminants include \_\_\_\_\_, microbiological contaminants (Giardia, viruses and bacteria) and low levels of varying types of organic chemicals.

- A. Untreated sewage
- B. Untreated Industrial waste
- C. Large debris
- D. Turbidity
- E. A and B
- F. None of the Above

138. Groundwater contaminants include naturally occurring inorganic chemicals (such as arsenic, fluoride, radium, radon and nitrate) and a number of \_\_\_\_\_ (VOCs) that have recently been detected in localized areas.

- A. Volatile organic chemicals
- B. Untreated Industrial waste
- C. Volatile organ compounds
- D. Turbidity
- E. A and B
- F. None of the Above

139. When selecting among the different treatment options, the water supplier must consider a number of factors. These include regulatory requirements, characteristics of the \_\_\_\_\_, configuration of the existing system, cost, operating requirements and future needs of the service area.

- A. Raw water
- B. Consumer confidence
- C. Change of climate
- D. Pumping
- E. A and B
- F. None of the Above

Preliminary Treatment

140. Most lakes and reservoirs are not free of logs, tree limbs, sticks, gravel, sand and rocks, weeds, leaves, and trash. If not removed, these will cause problems to the treatment plant's pumps and equipment. The best way to protect the plant is \_\_\_\_\_.

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

141. Bar screens are made of straight steel bars at the intake of the plant. The spacing of the horizontal bars \_\_\_\_\_.

- A. Vary in size
- B. Will rank the size
- C. Depends on intake
- D. Size does not matter
- E. A and B
- F. None of the Above

142. Wire mesh screens are woven stainless steel material and the opening of the fabric is narrow. They require \_\_\_\_\_.

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

143. Mechanical bar screens vary in size and use some type of raking mechanism that travels horizontally down the bars to scrap the debris off. The type of screening used depends on the \_\_\_\_\_ and the size of the intake.

- A. Organics
- B. Fish
- C. Flow rate
- D. Raw water
- E. A and B
- F. None of the Above

#### Pre-Sedimentation

144. Once the water passes the bar screens, sand and grit are still present. This will damage plant equipment and pipes, so it must be removed. This is generally done with either rectangular- or round-shaped basin prior to \_\_\_\_\_.

- A. Filtration
- B. Coagulation
- C. Purification
- D. Flocculation
- E. A and B
- F. None of the Above

145. Sedimentation basins are also used after the \_\_\_\_\_ process.

- A. Filtration
- B. Coagulation
- C. Purification
- D. Flocculation
- E. A and B
- F. None of the Above

146. Let's first look at the components of a rectangular clarifier. Most are designed with scrapers on the bottom to move the settled sludge to one or more hoppers at the influent end of the tank. It could have a \_\_\_\_\_ or traveling bridge used to collect the sludge.

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

147. The most common is a \_\_\_\_\_ collector. Most designs will have baffles to prevent short circuiting and scum from entering the effluent.

- A. Screw conveyor
- B. Conveyor belts and
- C. Dissolved air floatation
- D. Chain and flight
- E. A and B
- F. None of the Above

#### Flights and Chains

148. They move the settled sludge to the hopper in the clarifier for return and they also remove the scum from the \_\_\_\_\_ of the basin.

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

149. The flights are usually \_\_\_\_\_ flights mounted on parallel chains. The motor shaft is connected through a gear reducer to a shaft which turns the drive chain.

- A. Steel or brass
- B. Concrete
- C. Wood or nonmetallic
- D. Stainless steel
- E. A and B
- F. None of the Above

150. The drive chain \_\_\_\_\_ the drive sprockets and the head shafts. The shafts can be located overhead or below.

- A. Pushes
- B. Pulls
- C. Turns
- D. Travels
- E. A and B
- F. None of the Above

151. Some clarifiers may not have scum removal equipment, so the configuration of the shaft may vary. As the flights travel across the bottom of the clarifier, \_\_\_\_\_ are used to protect the flights.

- A. Wearing washers
- B. Wear rings
- C. Bearings
- D. Wearing shoes
- E. A and B
- F. None of the Above

152. To prevent damage due to overloads, a \_\_\_\_\_ is used.

- A. Bearings
- B. Gaskets
- C. Shear pin
- D. Ropes
- E. A and B
- F. None of the Above

153. The gear moves the drive chain. If a heavy load is put on the sludge collector system then the shear pin should break. This means that the gear would \_\_\_\_\_ around the shaft and movement of the drive chain would stop.

- A. Freeze up
- B. Simply slide
- C. Crack
- D. None of the above

#### Circular Clarifiers

154. In some circular or square tanks, \_\_\_\_\_ are used. The most common type has a center pier or column.

- A. Rotating scrapers
- B. Conveyor belts
- C. Dissolved air floatation
- D. Manual skimmers
- E. Clear wells
- F. None of the Above

155. The major mechanic parts of the clarifier are the \_\_\_\_\_; the sludge collector mechanism, and the scum removal system.

- A. Screw conveyor
- B. Conveyor belts
- C. Drive unit
- D. Chain and flight
- E. Clear well(s)
- F. None of the Above

156. Suspended particles carry an electrical charge which causes them to \_\_\_\_\_ one another.

- A. Attract
- B. Repel
- C. Disperse
- D. Mimic
- E. Add
- F. None of the Above

157. The conventional process uses \_\_\_\_\_ and cationic polymer to neutralize the charge. That allows suspended particles to clump together to form more easily filtered particles.

- A. Alkalinity
- B. Alum (aluminum sulfate)
- C. Powdered activated carbon
- D. Chlorine
- E. All of the above except B
- F. None of the Above

158. Alum combines with alkalinity in the \_\_\_\_\_ to form a white precipitate that neutralizes suspended particles' electrical charge and forms a base for coagulating those particles.

- A. Conventional technology
- B. Reconditioning cycle
- C. Raw water
- D. Depth filter
- E. All of the above except A
- F. None of the Above

159. \_\_\_\_\_ 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
  - B. Reconditioning cycle
  - C. Traditional sand filter
  - D. All of the above except C
  - E. None of the above
160. Traditional filter systems use graded silica \_\_\_\_\_. Since the sand grains all have about the same density, larger grains lay toward the bottom of the filter bed and finer grains lay at the top of the filter bed.
- A. Conventional technology
  - B. Sand filter media
  - C. Traditional sand filter
  - D. All of the above except A
  - E. None of the above
161. Filtration occurs only within the first few inches of the \_\_\_\_\_ at the top of the bed.
- A. Conventional technology
  - B. Reconditioning cycle
  - C. Finer grains
  - D. Depth filter
  - E. All of the above except D
  - F. None of the Above
162. A depth filter has four layers of filtration media, each of different size and density. Light, coarse material lies at the top of the \_\_\_\_\_.
- A. Conventional technology
  - B. Filter bed
  - C. Traditional sand filter
  - D. Depth filter
  - E. All of the above except B
  - F. None of the Above
163. The media become progressively finer and denser in the lower layers. Larger suspended particles are removed by the \_\_\_\_\_ while smaller particles are removed in the lower layers.
- A. Conventional technology
  - B. Reconditioning cycle
  - C. Traditional sand filter
  - D. Upper layers
  - E. All of the above except D
  - F. None of the Above
164. Particles are trapped throughout the bed, not in just the top few inches. That allows a depth filter to run substantially longer and use less backwash water than a \_\_\_\_\_.
- A. Conventional technology
  - B. Reconditioning cycle
  - C. Traditional sand filter
  - D. Depth filter
  - E. All of the above except C
  - F. None of the Above

165. As suspended particles accumulate in a \_\_\_\_\_, the pressure drop through the filter increases.

- A. Conventional technology
- B. Reconditioning cycle
- C. Filter bed
- D. Depth filter
- E. All of the above except A
- F. None of the Above

166. When the pressure difference between filter inlet and outlet increases by 5 - 10 psi (34 to 68 kPa) from the beginning of the cycle, the filter should be reconditioned. Operating beyond this pressure drop increases the chance of fouling - called " \_\_\_\_\_ " - within the filter.

- A. Conventional technology
- B. Reconditioning cycle
- C. Mud-balling
- D. Depth filter
- E. All of the above except B
- F. None of the Above

167. The \_\_\_\_\_ consists of an up-flow backwash followed by a down-flow rinse. Backwash is an up-flow operation, at about 14 gpm per square foot (34m/hr) of filter bed area that lasts about 10 minutes.

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional sand filter
- D. Depth filter
- E. All of the above except D
- F. None of the Above

168. Turbidity washes out of the filter bed as the filter media particles scour one another. The down-flow rinse settles the bed before the filter returns to service. \_\_\_\_\_ lasts about 5 to 10 minutes.

- A. Conventional technology
- B. Reconditioning cycle
- C. Traditional sand filter
- D. Fast rinse
- E. All of the above except A
- F. None of the Above

169. \_\_\_\_\_ is often used to enhance filter performance, particularly when turbidity includes fine colloidal particles.

- A. Conventional technology
- B. Chemical pretreatment
- C. Traditional sand filter
- D. Depth filter
- E. All of the above except D
- F. None of the Above

170. \_\_\_\_\_ are usually electrically charged. Feeding chemicals such as alum (aluminum sulfate), ferric chloride, or a cationic polymer neutralizes the charge, allowing the particles to cling to one another and to the filter media.

- A. Cationic polymer
- B. Suspended particles
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the above except B
- F. None of the Above

171. \_\_\_\_\_ may increase filtered water clarity, measured in NTU, by 90% compared with filtration alone.

- A. Cationic polymer
- B. Filtered water
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the Above
- F. None of the Above

172. If an operator is present to make adjustments for variations in the raw water, \_\_\_\_\_ clarity improvements in the range of 93 to 95% are achievable.

- A. Cationic polymer
- B. Filtered water
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the Above
- F. None of the Above

#### Package Plants

173. Representing a slight modification of \_\_\_\_\_, package plants are usually built in a factory, mounted on skids, and transported virtually assembled to the operation site.

- A. Cationic polymer
- B. Conventional filtration technology
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the Above
- F. None of the Above

174. These are appropriate for small community systems where full water treatment is desired, but without the construction costs and space requirements associated with separately constructed \_\_\_\_\_, filter beds, clear wells, etc.

- A. Cationic polymer
- B. Filtered water
- C. Chemical pretreatment
- D. Sedimentation basins
- E. All of the Above
- F. None of the Above

175. In addition to the conventional filtration processes, package plants are found as two types: tube-type clarifiers and \_\_\_\_\_.

- A. Filtration
- B. Adsorption clarifiers
- C. Chemical pretreatment
- D. Sedimentation process
- E. None of the Above

Direct Filtration Plant vs. Conventional Plant

176. The only difference is that the \_\_\_\_\_ or step is omitted from the Direct Filtration plant.

- A. Filtration
- B. Filtered water
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the Above
- F. None of the Above

Rapid Sand Filtration

177. Also known as \_\_\_\_\_, this is the most prevalent form of water treatment technology in use today.

- A. Cationic polymer treatment
- B. Rapid-sand filtration
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the Above
- F. None of the Above

178. This filtration process employs a combination of \_\_\_\_\_ in order to achieve maximum effectiveness.

- A. Filtration
- B. Physical and chemical processes
- C. Chemical pretreatment
- D. Sedimentation process
- E. All of the Above
- F. None of the Above

Coagulation

179. At the Water Treatment Plant, \_\_\_\_\_, commonly called alum, is added to the water in the "flash mix" to cause microscopic impurities in the water to clump together.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

180. The alum and the water are mixed rapidly by the \_\_\_\_\_. The resulting larger particles will be removed by filtration.

- A. Cationic polymers
- B. Flash mixer
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

181. \_\_\_\_\_ is the process of joining together particles in water to help remove organic matter.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

182. When solid matter is too small to be removed by a depth filter, the fine particles must be coagulated, or "stuck together" to form larger particles which can be filtered. This is achieved through the used of \_\_\_\_\_.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

183. \_\_\_\_\_ are required since colloidal particles by themselves have the tendency to stay suspended in water and not settle out.

- A. Cationic polymers
- B. Coagulation aids
- C. Coagulant chemicals
- D. Aluminum Sulfate chemicals
- E. All of the Above
- F. None of the Above

184. This is primarily due to a negative charge on the surface of the particles. All matter has a residual surface charge to a certain degree. But since \_\_\_\_\_ 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

185. The like charges on the \_\_\_\_\_ repel each other, and they stay suspended in water.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

186. \_\_\_\_\_ such as "alum" (aluminum Sulfate) work by neutralizing the negative charge, which allows the particles to come together.

- A. Cationic polymers aids
- B. Coagulation
- C. Coagulant chemicals
- D. All of the Above
- E. None of the above

187. Other coagulants are called "\_\_\_\_\_", which 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
- B. Coagulation helpers
- C. Coagulant chemicals
- D. Aluminum Sulfate salts
- E. All of the Above
- F. None of the Above

188. New chemicals have been developed which combine the properties of alum-type coagulants and \_\_\_\_\_. Which chemical is used depends on the application, and will usually be chosen by the engineer designing the water treatment system.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

189. \_\_\_\_\_ is the most widely used coagulant in water treatment. Coagulation is necessary to meet the current regulations for almost all potable water plants using surface water.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

190. Aluminum Sulfate is also excellent for removing nutrients such as phosphorous in wastewater treatment. Liquid \_\_\_\_\_ is a 48.86% solution.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

191. Large microorganisms, including algae and amoebic cysts, are readily removed by \_\_\_\_\_ and filtration. Bacterial removals of 99% are also achievable.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. Aluminum Sulfate
- E. All of the Above
- F. None of the Above

192. More than 98% of poliovirus type 1 was removed by conventional \_\_\_\_\_ and filtration. Several recent studies have shown that bacteria and viral agents are attached to organic and inorganic particulates.

- A. Cationic polymers
- B. Coagulation
- C. Coagulant chemicals
- D. All of the Above
- E. None of the above

193. \_\_\_\_\_ by conventional coagulation and filtration is a major component of effective treatment for the removal of pathogens.

- A. Removal of these particulates
- B. Agitation of the water
- C. Floc particles mix
- D. Destabilized or coagulated particles
- E. All of the Above
- F. None of the Above

Flocculation

194. The process of bringing together \_\_\_\_\_ to form larger masses which can be settled and/or filtered out of the water being treated.

- A. Equalization basin
- B. Agitation of the water
- C. Floc particles mix
- D. Destabilized or coagulated particles
- E. All of the Above
- F. None of the Above

195. In this process, which follows the rapid mixing, the chemically treated water is sent into a basin where the suspended particles can collide, \_\_\_\_\_ (stick together), and form heavier particles called "floc".

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

196. Gentle \_\_\_\_\_ and appropriate detention times (the length of time water remains in the basin) help facilitate this process.

- A. Equalization basin
- B. Agitation of the water
- C. Floc particles mix
- D. Destabilized or coagulated particles
- E. All of the Above
- F. None of the Above

197. The water is slowly mixed in contact chambers allowing the coagulated particles, now called "floc," to become larger and stronger. As these \_\_\_\_\_ in the water, bacteria and other microorganisms are caught in the floc structure.

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

Pre-Sedimentation

198. Depending on the quality of the source water, some plants have pre-sedimentation. To allow larger \_\_\_\_\_ in a reservoir or lake (sand, heavy silt) reducing solid removal loads.

- A. Particles time to settle
- B. Agitation of the water
- C. Floc particles to mix
- D. Coagulated particles
- E. All of the Above
- F. None of the Above

199. Provides an equalization basin which \_\_\_\_\_.
- A. Evens out fluctuations
  - B. Agitation of the water
  - C. Floc particles mix
  - D. Destabilized or coagulated particles
  - E. All of the Above
  - F. None of the Above

#### Sedimentation

200. The process of \_\_\_\_\_ (going to the bottom of the vessel) in water.
- A. Suspended solid particles settling out
  - B. Agitation of the water
  - C. Floc particles mix
  - D. Destabilized or coagulated particles
  - E. All of the Above
  - F. None of the Above

201. Following flocculation, a sedimentation step may be used. During sedimentation, the velocity of the water is decreased so that the suspended material, including flocculated particles, \_\_\_\_\_ by gravity.
- A. Can settle out
  - B. Agitation of the water
  - C. Floc particles mix
  - D. Destabilized or coagulated particles
  - E. All of the Above
  - F. None of the Above

202. Once settled, the \_\_\_\_\_ that is later removed from the bottom of the basin.
- A. Particles combine to form a sludge
  - B. Agitation of the water
  - C. Floc particles will mix
  - D. Destabilized or coagulated particles will form
  - E. All of the Above
  - F. None of the Above

#### Filtration

203. A water treatment step used to remove turbidity, dissolved organics, odor, taste and color. The water flows by gravity through large filters of \_\_\_\_\_, silica sand, garnet and gravel. The floc particles are removed in these filters.
- A. Activated carbon filters
  - B. Cartridge filters
  - C. Anthracite coal
  - D. Rapid-sand filters
  - E. All of the Above
  - F. None of the Above

204. The rate of filtration can be adjusted to meet water consumption needs. 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. Granular synthetic material
  - D. Rapid-sand filters
  - E. All of the Above
  - F. None of the Above

205. The most widely used 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. Granular synthetic material
- D. Rapid-sand filters
- E. All of the Above
- F. None of the Above

206. The filter is periodically cleaned by a reversal of flow and the \_\_\_\_\_ into a drain.

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

207. \_\_\_\_\_ made of fabric, paper, or plastic material are also common and are often much smaller and cheaper, as well as disposable.

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

208. Filters are available in several ratings, depending on the size of \_\_\_\_\_.

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

209. \_\_\_\_\_, will also remove turbidity, but would not be recommended for that purpose only.

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

210. With most of the larger particles settled out, the water now goes to the \_\_\_\_\_. 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. Activated carbon filters
- B. Filtration process
- C. Granular synthetic material
- D. Rapid-sand filters
- E. All of the Above
- F. None of the Above

211. Anthracite coal or \_\_\_\_\_ may also be included in the sand to improve the filtration process, especially for the removal of organic contaminants and taste and odor problems.

- A. Head loss
- B. Uniform the media
- C. Activated carbon
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

212. Evaluation of overall \_\_\_\_\_ should be conducted on a routine basis, at least once per day.

- A. Head loss
- B. Filtration process performance
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

213. Poor chemical treatment can often result in either early turbidity breakthrough or rapid head loss buildup. The more \_\_\_\_\_, the slower head loss buildup.

- A. Head loss
- B. Uniform the media
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

214. All water treatment plants that use surface water are governed by the \_\_\_\_\_.

- A. Head loss
- B. Uniform the media
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

#### Declining Rate Filters

215. The flow rate will vary with \_\_\_\_\_. Each filter operates at the same rate, but can have a variable water level.

- A. Head loss
- B. Uniform the media
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

216. This system requires a(n) \_\_\_\_\_ (weir) to provide adequate media submergence.

- A. Head loss
- B. Uniform the media
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

#### Detention Time

217. The actual time required for a small amount of water to pass through a \_\_\_\_\_ 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. Head loss
- B. Sedimentation basin
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

#### Disinfection

218. Chlorine is added to the water at the flash mix for pre-disinfection. The chlorine kills or inactivates harmful microorganisms. Chlorine is added again after filtration for \_\_\_\_\_.

- A. Head loss
- B. Uniform the media
- C. Effluent control structure
- D. Post-disinfection
- E. All of the Above
- F. None of the Above

#### Jar Testing

219. Jar testing traditionally has been done on a routine basis in most water treatment plants to control the \_\_\_\_\_. Much more information, however, can be obtained with only a small modification in the conventional method of jar testing. It is the quickest and most economical way to obtain good reliable data on the many variables which affect the treatment process.

- A. Chlorine
- B. Coagulants
- C. Natural water
- D. Coagulant dose
- E. All of the Above
- F. None of the Above

#### pH

220. 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. Most \_\_\_\_\_ has a pH between 6.0 and 8.5.

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

#### Caustic

221. NaOH (also called Sodium Hydroxide) is a strong chemical used in the treatment process to neutralize acidity, \_\_\_\_\_, or raise the pH value.

- A. Chlorine
- B. Coagulants
- C. Natural water
- D. Coagulant dose
- E. All of the Above
- F. None of the Above

Polymer

222. A type of chemical, when combined with other types of coagulants, aids in binding small \_\_\_\_\_ to larger particles to help in the settling and filtering processes.

- A. Chlorine
- B. Coagulants
- C. Suspended particles
- D. Coagulant dose
- E. All of the Above
- F. None of the Above

Post-Chlorine

223. Where the water is chlorinated to make sure it holds a \_\_\_\_\_ in the distribution system.

- A. Residual
- B. Coagulants
- C. Natural water
- D. Coagulant dose
- E. All of the Above
- F. None of the Above

Pre-Chlorine

224. Where the raw water is dosed with a large concentration of \_\_\_\_\_.

- A. Chlorine
- B. Coagulants
- C. Natural water
- D. Coagulant dose
- E. All of the Above
- F. None of the Above

Pre-Chlorination

225. The addition of \_\_\_\_\_ before the filtration process will help: control algae and slime growth.

- A. Chlorine
- B. Coagulants
- C. Natural water
- D. Coagulant dose
- E. All of the Above
- F. None of the Above

Raw Turbidity

226. The turbidity of the water coming to the treatment plant from the \_\_\_\_\_ source.

- A. Chlorine basin
- B. Coagulant basin or
- C. Raw water
- D. Neutral
- E. All of the Above
- F. None of the Above

Settled Solids

227. Solids that have been removed from the \_\_\_\_\_ by the coagulation and settling processes.

- A. Turbidity machine
- B. Raw water
- C. First step
- D. Subsequent treatment processes
- E. All of the Above
- F. None of the Above

Hydrofluosilicic Acid

228. ( $H_2SiF_6$ ) a clear, \_\_\_\_\_ with a pH ranging from 1 to 1.5. Used in water treatment to fluoridate drinking water.

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

Corrosion Control

229. The pH of the water is adjusted with \_\_\_\_\_, commonly called soda ash. Soda ash is fed into the water after filtration.

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

Zinc Orthophosphate

230. A chemical used to coat the pipes in the \_\_\_\_\_ to inhibit corrosion.

- A. Turbidity
- B. Raw water
- C. Fluoridate drinking water
- D. Subsequent treatment processes
- E. All of the Above
- F. None of the Above

Taste and Odor Control

231. \_\_\_\_\_ is occasionally added for taste and odor control. PAC is added to the flash mix.

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

Water Quality

232. Water testing is conducted throughout the treatment process. Items like \_\_\_\_\_, pH, and chlorine residual are monitored and recorded continuously. Some items are tested several times per day, some once per quarter and others once per year.

- A. Turbidity
- B. Raw water
- C. Fluoride drinking water chemical
- D. Subsequent treatment processes
- E. All of the Above
- F. None of the Above

Sampling

233. Collect the \_\_\_\_\_ at least 6 inches under the surface by plunging the container mouth down into the water and turning the mouth towards the current by dragging the container slowly horizontal.

- A. Turbidity
- B. Water sample
- C. Fluoridate drinking water sample
- D. Mudball
- E. All of the Above
- F. None of the Above

234. Care should be taken not to disturb the bottom of the \_\_\_\_\_ or along the sides. So as not to stir up any settled solids. This would create erroneous results.

- A. Turbidity source
- B. Water source
- C. Filter
- D. Basin
- E. All of the Above
- F. None of the Above

Chemical feed and rapid mix

235. Chemicals are added to the water in order to \_\_\_\_\_. These may include pH adjusters and coagulants.

- A. Presume detention times
- B. Improve the subsequent treatment processes
- C. Modify y the conventional process
- D. Adjust up-flow clarifier
- E. All of the Above
- F. None of the Above

236. 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 \_\_\_\_\_ (settling) or filtration.

- A. Adjusting detention times
- B. Sedimentation
- C. Modifying conventional process
- D. Opening the clarifier
- E. All of the Above
- F. None of the Above

237. A variety of \_\_\_\_\_, such as baffles, static mixers, impellers, and in-line sprays can be used to mix the water and distribute the chemicals evenly.

- A. Presumed detention times
- B. Sedimentation/clarification process
- C. Modification of the conventional process
- D. An up-flow clarifier with low-density plastic bead media
- E. All of the Above
- F. None of the Above

#### Short-Circuiting

238. 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. This 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 with low-density plastic bead media
- E. All of the Above
- F. None of the Above

#### Tube Settlers

239. This modification of the conventional process contains many metal "tubes" that are placed in the \_\_\_\_\_, or clarifier.

- A. Presumed detention times
- B. Sedimentation basin
- C. Modification of the conventional process
- D. An up-flow clarifier with low-density plastic bead media
- E. All of the Above
- F. None of the Above

240. These tubes are approximately 1 inch deep and 36 inches long, split-hexagonal shape, and installed at an angle of \_\_\_\_\_ or less.

- A. Presumed detention times
- B. Sedimentation/clarification process
- C. Modification of the conventional process
- D. Low-density plastic bead media
- E. All of the Above
- F. None of the Above

241. These tubes provide for a very large surface area upon which particles may settle as the water flows upwards. The slope of the tubes facilitates gravity settling of the solids to the bottom of the basin, where they can be \_\_\_\_\_.

- A. Presumed detention times
- B. Sedimentation/clarification process
- C. Modification of the conventional process
- D. Collected and removed
- E. All of the Above
- F. None of the Above

242. The large surface settling area also means that adequate clarification can be obtained with detention times of 15 minutes or less. As with \_\_\_\_\_ treatment, this sedimentation step is followed by filtration through mixed media.

- A. Presumed detention times
- B. Sedimentation/clarification process
- C. Conventional
- D. An up-flow clarifier
- E. All of the Above
- F. None of the Above

#### Adsorption Clarifiers

243. The concept of the \_\_\_\_\_ was developed in the early 1980's. This technology uses an up-flow clarifier with low-density plastic bead media, usually held in place by a screen.

- A. Adsorption clarifier package plant
- B. Sedimentation/clarification process
- C. Conventional process
- D. Up-flow clarifier process
- E. All of the Above
- F. None of the Above

244. This adsorption media is designed to enhance the sedimentation/clarification process by combining flocculation and sedimentation into one step. In this step, 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. A modification of the conventional process
- D. Decreased
- E. All of the Above
- F. None of the Above

245. Air scouring \_\_\_\_\_ followed by water flushing. Cleaning of this type of clarifier is initiated more often than filter backwashing because the clarifier removes more solids.

- A. Presumed detention times
- B. Cleans adsorption clarifiers
- C. Increases by adsorption
- D. Reduces by adsorption
- E. All of the Above
- F. None of the Above

246. Tube-settler type of package plant, the \_\_\_\_\_ is followed by mixed-media filtration and disinfection to complete the water treatment.

- A. Detention times
- B. Sedimentation/clarification process
- C. Modification of the conventional process
- D. Lunch hour
- E. All of the Above
- F. None of the Above

Clearwell

247. The final step in the conventional filtration process, the clearwell provides temporary storage for the treated water. The two main purposes for this storage are to have filtered water available for backwashing the filter, and to \_\_\_\_\_ (or contact time) for the chlorine (or other disinfectant) to kill any microorganisms that may remain in the water.

- A. Enforce standards to protect
- B. Filter and disinfection
- C. Influence bacteria to change to dead stasis
- D. Provide detention time
- E. All of the Above
- F. None of the Above

EPA Filter Backwash Rule

248. The U.S. Environmental Protection Agency (EPA) has finalized the Long Term 1 Enhanced Surface Water Treatment Rule and Filter Backwash Rule (LT1FBR) 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

249. This rule will apply to public water systems using surface water or ground water under the direct \_\_\_\_\_.

- A. Enforceable standards to protect
- B. Filtration and disinfection can remove
- C. Influence of surface water
- D. Main purposes for this storage
- E. All of the Above
- F. None of the Above

250. This rule will extend protections against \_\_\_\_\_ and other disease-causing microbes to the 11,500 small water systems which serve fewer than 10,000 people annually.

- A. Enforceable standards
- B. Filtration and disinfection
- C. Influence of surface water
- D. Outbreaks
- E. All of the Above
- F. None of the Above

251. This rule also establishes filter backwash requirements for certain public water systems of all sizes. The \_\_\_\_\_ will reduce the potential risks associated with recycling contaminants removed during the filtration process.

- A. Enforceable standards
- B. Filter backwash requirements
- C. Influence of surface water
- D. Main purposes
- E. All of the Above
- F. None of the Above

Background

252. The Safe Drinking Water Act (SDWA) requires the EPA to set \_\_\_\_\_ public health from contaminants which may occur in drinking water.

- A. Enforceable standards to protect
- B. Filtration and disinfection can remove
- C. Influence of surface water
- D. Main purposes for this storage
- E. All of the Above
- F. None of the Above

253. The EPA has determined that the presence of microbiological contaminants is a health concern. If finished water supplies contain \_\_\_\_\_, disease outbreaks may result.

- A. Disease symptoms
- B. Cryptosporidium
- C. Waterborne diseases
- D. Microbiological contaminants
- E. All of the Above
- F. None of the Above

254. \_\_\_\_\_ may include diarrhea, cramps, nausea, possibly jaundice, and headaches and fatigue.

- A. Disease symptoms
- B. Cryptosporidium
- C. Waterborne disease outbreaks
- D. Microbiological contaminants
- E. All of the Above
- F. None of the Above

255. The EPA has set enforceable drinking water treatment requirements to reduce the risk of \_\_\_\_\_.

- A. Disease symptoms
- B. Control of Cryptosporidium
- C. Waterborne disease outbreaks
- D. Microbiological pollutants
- E. All of the Above
- F. None of the Above

256. Treatment technologies such as filtration and disinfection can remove or inactivate \_\_\_\_\_.

- A. Disease symptoms
- B. Cysts
- C. Foodborne disease outbreaks
- D. Microbiological contaminants
- E. All of the Above
- F. None of the Above

257. Physical removal is critical to the \_\_\_\_\_ because it is highly resistant to standard disinfection practice.

- A. Disease symptoms process
- B. Control of Cryptosporidium
- C. Anal to mouth process
- D. Process
- E. All of the Above
- F. None of the Above

258. Cryptosporidiosis may manifest itself as a severe infection that can last several weeks and may cause the \_\_\_\_\_compromised immune systems. In 1993, Cryptosporidium caused over 400,000 people in Milwaukee to experience intestinal illness.

- A. Disease symptoms
- B. Death of individuals with
- C. Waterborne disease outbreaks
- D. Microbiological contaminants
- E. A and D
- F. None of the Above

259. More than 4,000 were hospitalized, and at least 50 deaths were attributed to the \_\_\_\_\_ outbreak.

- A. Cryptosporidium
- B. Cryptosporidiosis
- C. Waterborne disease outbreaks
- D. Microbiological contaminants
- E. A and D
- F. None of the Above

260. The 1996 Amendments to SDWA require the EPA to promulgate an Interim Enhanced Surface Water Treatment Rule (IESWTR) and a \_\_\_\_\_ (announced in December 1998).

- A. Stage 1 Disinfection Byproducts Rule
- B. LT1FBR
- C. IESWTR
- D. Public water systems
- E. A and D
- F. None of the Above

261. The \_\_\_\_\_ set the first drinking water standards to control Cryptosporidium in large water systems, by establishing filtration and monitoring requirements for systems serving more than 10,000 people each.

- A. Stage 1 Disinfection Byproducts Rule
- B. LT1FBR
- C. IESWTR
- D. A and B
- E. None of the above

262. The \_\_\_\_\_ proposal builds on those standards by extending the requirements to small systems.

- A. Stage 1 Disinfection Byproducts Rule
- B. LT1FBR
- C. IESWTR
- D. Public water systems
- E. A and D
- F. None of the Above

What will the LT1FBR require?

263. The \_\_\_\_\_ provisions will apply to public water systems using surface water or ground water under the direct influence of surface water systems.

- A. Stage 1 Disinfection Byproducts Rule
- B. LT1FBR
- C. IESWTR
- D. Public water systems
- E. None of the Above

LT1 Provisions - Apply to systems serving fewer than 10,000 people, and fall into the three following categories:

Turbidity

264. Conventional and \_\_\_\_\_ must comply with specific combined filter effluent turbidity requirements.

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

265. Conventional and \_\_\_\_\_ must comply with individual filter turbidity requirements.

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

Disinfection Benchmarking

266. 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

267. If a system considers making a significant change to their disinfection practice they must develop a(n) \_\_\_\_\_ and receive State approval for implementing the change.

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

Other Requirements

268. 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

269. Removal of \_\_\_\_\_ plays an important role in the natural treatment of groundwater as it percolates through the soil. It is also a major part of most water treatment.

- A. Coagulation and flocculation processes
- B. Coagulation or oxidation processes
- C. Serious problems in filter operation
- D. Suspended solids by filtration
- E. A and D
- F. None of the Above

270. Groundwater that has been softened or treated through iron and manganese removal will require filtration to remove floc created by \_\_\_\_\_.

- A. Coagulation and flocculation may occur in the filter bed
- B. Coagulation or oxidation processes
- C. Serious problems in filter operation
- D. A combination of complex physical and chemical mechanisms
- E. A and D
- F. None of the Above

271. Since surface water sources are subject to run-off and do not undergo natural filtration, it must be filtered to \_\_\_\_\_.

- A. Aid the coagulation and flocculation processes
- B. Provide coagulation or oxidation processes
- C. Remove particles and impurities
- D. Retain the combination of complex physical and chemical mechanisms
- E. A and D
- F. None of the Above

272. The filter used in the \_\_\_\_\_ that traps suspended material between the grains of filter media.

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

273. 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. A and D
- F. None of the Above

274. Filtration primarily depends on a \_\_\_\_\_, the most important being adsorption.

- A. Coagulation and flocculation process
- B. Coagulation or oxidation processes
- C. Serious problems in filter operation
- D. Combination of complex physical and chemical mechanisms
- E. A and D
- F. None of the Above

275. Adsorption is the process of particles sticking onto the surface of the individual filter grains or onto the previously deposited materials. The forces that attract and hold the particles to the grains are the same as those that work in \_\_\_\_\_.

- A. Coagulation and flocculation
- B. Coagulation or oxidation processes
- C. Main filter
- D. Complex physical and chemical mechanisms
- E. A and B
- F. None of the Above

276. Some \_\_\_\_\_, especially if coagulation and flocculation of the water before filtration was not properly controlled. Incomplete coagulation can cause serious problems in filter operation.

- A. Coagulation and flocculation may occur in the filter bed
- B. Coagulation or oxidation processes will work
- C. Serious problems in filter operation
- D. Physical and chemical mechanisms
- E. A and B
- F. None of the Above

#### Types of Filters

277. Several types of filters are used for water treatment. The earliest ones developed were the \_\_\_\_\_. They typically have filter rates of around 0.05 gpm/ft<sup>2</sup> of surface area. This type of filter requires large filter areas.

- A. Schmutzdecke
- B. Slow rate filtration
- C. Backwash
- D. Slow sand filters
- E. A and C
- F. None of the Above

278. The top several inches of the sand has to be removed regularly, usually by hand due to the mass of growing material ("\_\_\_\_\_") that collects in the filter. The sand removed is usually washed and returned to the filter.

- A. Schmutzdecke
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and D
- F. None of the Above

279. These filters are still in use in some small plants, especially in the western United States, as well as in many developing countries. They may also be used as a final step in wastewater treatment. Most filters are classified by filtration rate, type of \_\_\_\_\_, or type of operation.

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

### Rapid Sand Filters

280. Rapid sand filters can accommodate filter rates 40 times those of \_\_\_\_\_.

- A. Rapid sand filters
- B. Slow sand filters
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

281. The \_\_\_\_\_ is generally constructed of concrete and is most often rectangular.

- A. Rapid sand filters
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

282. Filters in large plants are usually constructed next to each other in a row, allowing the piping from the \_\_\_\_\_ to feed the filters from a central pipe gallery.

- A. Rapid sand filters
- B. Sedimentation basins
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

283. Some smaller plants are designed with the filters forming a square of four filters with a central pipe gallery feeding the filters from a \_\_\_\_\_.

- A. Rapid sand filters
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

### Filter Sand

284. The filter sand used in rapid sand filters is manufactured specifically for the purpose of water filtration. Most \_\_\_\_\_ contain 24-30 inches of sand, but some newer filters are deeper. The sand used is generally 0.4 to 0.6 mm in diameter.

- A. Rapid sand filters
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

285. This is larger than the sand used in slow rate filtration. The coarser sand in the \_\_\_\_\_ has larger voids that do not fill as easily.

- A. Rapid filters
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

286. The gravel installed under the sand layer(s) in the filter prevents the \_\_\_\_\_ from being lost during the operation.

- A. Filter sand
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

287. The \_\_\_\_\_ also distributes the backwash water evenly across the total filter. This under-gravel supports the filter sand and is usually graded in three to five layers, each generally 6-18 inches in thickness, depending on the type of underdrain used.

- A. Rapid sand filters
- B. Slow rate filtration
- C. Backwash
- D. Filter rates
- E. A and B
- F. None of the Above

288. A pipe lateral system uses a \_\_\_\_\_ with several perforated laterals on each side. Piping materials include cast iron, asbestos cement, and PVC. The perforations are usually placed on the underside of the laterals to prevent them from plugging with sand.

- A. Rapid sand filter
- B. Control manifold
- C. Backwash
- D. Filter rate
- E. A and B
- F. None of the Above

289. This also allows the backwash to be directed against the floor, which helps keep the gravel and \_\_\_\_\_ from being directly disturbed by the high velocity water jets.

- A. Sand Beds
- B. Slow rate filtration
- C. Backwash
- D. Filter rate
- E. A and B
- F. None of the Above

False floor

290. 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 filters
- B. Slow rate filtration
- C. Backwash
- D. Filter underdrain
- E. A and B
- F. None of the Above

291. This type of underdrain allows the \_\_\_\_\_ or open space under the floor to act as the collection area for the filtered water and for the distribution of the filter backwash water.

- A. Rapid sand filters
- B. Slow rate filtration
- C. Plenum
- D. Filter rates
- E. A and B
- F. None of the Above

Leopold system

292. 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. Backwashing of the filter or backwash cycle
- D. Removed filtered water
- E. A and B
- F. None of the Above

293. This type of \_\_\_\_\_ used with an undergravel layer, although some new designs allow for sand retention without gravel.

- A. Backwash water Or troughs
- B. Surface wash system
- C. Backwashing of the filter or backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

Washwater Troughs

294. Washwater troughs placed above the filter media collect the \_\_\_\_\_ and carry it to the drain system.

- A. Backwash water
- B. Surface wash system
- C. Backwashing of the filter or backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

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

- A. Backwash
- B. Surface wash system
- C. Backwashing of the filter or backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

296. The wash troughs must be installed at the same elevation so that they remove the \_\_\_\_\_ evenly from the filter and so that an even head is maintained across the entire filter.

- A. Backwash water Or troughs
- B. Surface wash system
- C. Backwash
- D. Remove the filtered water
- E. A and B
- F. None of the Above

297. These \_\_\_\_\_ are constructed from concrete, plastic, fiberglass, or other corrosion-resistant materials.

- A. Backwash troughs
- B. Surface wash system
- C. Backwashing of the filter or backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

298. During the operation of a filter, the upper six-to-ten inches of the filter media remove most of the suspended material from the water. It is important that this layer be thoroughly cleaned during the \_\_\_\_\_.

- A. Backwash water troughs
- B. Surface wash system
- C. Backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

299. Normal backwashing does not, in most cases, clean this layer completely; therefore, some method of agitation is needed to break up the top layers of the filter and to help the \_\_\_\_\_ remove any material caught there.

- A. Backwash water
- B. Surface wash system
- C. Backwashing of the filter or backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

300. This jet action will generally be supplied by rotating arms that are activated during the backwashing of the filter. A newer design of \_\_\_\_\_ uses compressed air to mix the upper layer and loosen the particles from the sand so that the backwash water can remove the particles more easily.

- A. Backwash water Or troughs
- B. Surface wash
- C. Backwashing of the filter or backwash cycle
- D. Remove the filtered water
- E. A and B
- F. None of the Above

#### National Drinking Water Regulations

301. The \_\_\_\_\_ establishes national standards of which the states are responsible for enforcing.

- A. EPA
- B. Local official
- C. State official
- D. Town mayor
- E. A and B
- F. None of the Above

302. Primary drinking water regulations, by definition, include either a \_\_\_\_\_ (MCL) or, when a MCL is not economically or technologically feasible, a prescribed treatment technique which would prevent adverse health effects to humans.

- A. Maximum contaminant level
- B. Consumer Confidence Reports
- C. Maximum Containment Level Goals
- D. Levels of regulated contaminants
- E. A and B
- F. None of the Above

303. The Act instructs the EPA on how to select \_\_\_\_\_ and specifies how the EPA must establish national primary drinking water regulations once a contaminant has been selected.
- A. Adverse health effects
  - B. Consumer Confidence Reports
  - C. Maximum Containment Level Goals
  - D. Contaminants for regulation
  - E. A and B
  - F. None of the Above

#### Contaminant Selection

304. P.L. 104-182 establishes a new process for the EPA to select contaminants for regulatory consideration based on occurrence, health effects, and meaningful opportunity for health risk reduction. By February 1998 and \_\_\_\_\_, the EPA must publish a list of contaminants that may warrant regulation.
- A. Regulate at least 5
  - B. Every 5 years
  - C. Is a two-part process
  - D. Within 30 day
  - E. A and B
  - F. None of the Above

305. The EPA must determine whether or not to \_\_\_\_\_ of the listed contaminants. The Act directs the EPA to evaluate contaminants that present the greatest health concern and to regulate contaminants that occur at concentration levels and frequencies of public health concern.
- A. Regulate at least 5
  - B. Every 5 years
  - C. Is a two-part process
  - D. Within 30 day
  - E. A and B
  - F. None of the Above

306. The law also includes a schedule for the EPA to complete regulations for disinfectants and disinfection byproducts (D/DBPs) and \_\_\_\_\_.
- A. Cryptosporidium
  - B. Non-enforceable
  - C. Enforceable
  - D. Feasible
  - E. A and B
  - F. None of the Above

#### Standard Setting

307. For each contaminant that the EPA has determined merits regulation, the EPA must set a non-enforceable maximum contaminant level goal (MCLG) at a level at which no known or anticipated adverse \_\_\_\_\_ health effects occur, and which allows an adequate margin of safety.
- A. Cryptosporidium
  - B. Non-enforceable
  - C. Enforceable
  - D. Feasible
  - E. A and B
  - F. None of the Above

308. The EPA must then set an enforceable standard, a maximum contaminant level (MCL), as close to the MCLG as is " \_\_\_\_\_" using the best technology, treatment techniques, or other means available (taking costs into consideration).

- A. Cryptosporidium
- B. Non-enforceable
- C. Enforceable
- D. Feasible
- E. A and B
- F. None of the Above

309. Standards are generally based on technologies that are affordable for large communities; however, under P.L. 104-182, each regulation establishing an MCL must list any \_\_\_\_\_, treatment techniques, or other means that comply with the MCL and that are affordable for three categories of small public water systems.

- A. Technologies
- B. Contaminants
- C. Risk reduction
- D. Treatment processes
- E. A and B
- F. None of the Above

310. The 1996 Amendments authorize the EPA to set a standard at other than the feasible level if the feasible level would lead to an increase in health risks by increasing the concentration of other contaminants or by interfering with the \_\_\_\_\_ used to comply with other SDWA regulations.

- A. Technologies
- B. Contaminants
- C. Risk reduction
- D. Treatment processes
- E. A and B
- F. None of the Above

311. Also, when proposing a regulation, the \_\_\_\_\_ must now publish a determination as to whether or not the benefits of the standard justify the costs.

- A. Federal government
- B. NRWA
- C. State official
- D. EPA
- E. A and B
- F. None of the Above

312. If the EPA determines that the benefits do not justify the costs, the EPA may, with certain exceptions, promulgate a standard that maximizes health \_\_\_\_\_ benefits at a cost that is justified by the benefits.

- A. Technologies
- B. Contaminants
- C. Risk reduction
- D. Costs
- E. A and B
- F. None of the Above

State Primacy

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

- A. Regulation
- B. Non-enforceable
- C. Enforcement
- D. Feasible
- E. A and B
- F. None of the Above

314. Whenever the EPA finds that a public water system in a state with primary enforcement authority does not comply with regulations, the Agency must notify \_\_\_\_\_ and the system and provide assistance to bring the system into compliance.

- A. The Federal government
- B. The CWA
- C. The State
- D. EPA
- E. A and B
- F. None of the Above

315. If the state fails to commence enforcement action \_\_\_\_\_ after the notification, the EPA is authorized to issue an administrative order or commence a civil action.

- A. Regulate at least 5
- B. Every 5 years
- C. Is a two-part process
- D. Within 30 day
- E. A and B
- F. None of the Above

Nonprimacy State

316. In a nonprimacy state, the EPA must notify an elected local official (if any has jurisdiction over the water system) before commencing an \_\_\_\_\_ action against the system.

- A. Cryptosporidium
- B. Non-enforceable
- C. Enforcement
- D. Feasible
- E. A and B
- F. None of the Above

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

- A. Alternative monitoring
- B. Permanent monitoring
- C. Contaminants detected
- D. Reasonably available
- E. A and B
- F. None of the Above

318. \_\_\_\_\_ with approved source water protection programs may adopt alternative monitoring requirements to provide permanent monitoring relief to qualified systems for chemical contaminants.

- A. Federal government
- B. NRWA
- C. States
- D. EPA
- E. A and B
- F. None of the Above

319. P.L. 104-182 requires states to adopt programs for training and certifying operators of community and nontransient noncommunity systems. The EPA must publish guidelines specifying minimum standards for operator certification by February 1999. \_\_\_\_\_, the EPA must withhold 20% of a state's SRF grant unless the state has an operator certification program (Section 1419).

- A. Two years thereafter
- B. Every 5 years
- C. Is a two-part process
- D. Within 30 day
- E. A and B
- F. None of the Above

#### Other Provisions

320. Public water systems must notify customers of violations with potential for serious health effects \_\_\_\_\_.

- A. Regulate at least 5
- B. Every 5 years
- C. within 24 hours
- D. Within 30 day
- E. A and B
- F. None of the Above

321. Systems must also issue to customers \_\_\_\_\_ on contaminants detected in their drinking water.

- A. Alternative monitoring
- B. Permanent monitoring
- C. Annual reports
- D. Reasonably available
- E. All of the above except A
- F. None of the Above

322. Section 1417 requires any pipe, solder, or flux used in the installation or repair of public water systems or of plumbing in residential or nonresidential facilities providing drinking water to be " \_\_\_\_\_ " (as defined in the Act).

- A. Filtered
- B. Replaced
- C. Lead free
- D. Chlorinated
- E. All of the above except C
- F. None of the Above

323. The Administrator has emergency powers to issue orders and commence \_\_\_\_\_ if a contaminant likely to enter a public drinking water supply system poses a substantial threat to public health and state or local officials have not taken adequate action.

- A. Civil action
- B. Non-enforceable
- C. Enforceable
- D. Feasible
- E. All of the above except A
- F. None of the Above

324. If a chemical necessary for water treatment is not reasonably available, the Administrator can issue a "\_\_\_\_\_", in which case the President can order an allocation of the chemical to those needing it.

- A. Alternative monitoring
- B. Permanent monitoring
- C. Certification of need
- D. Reasonably available
- E. All of the above except A
- F. None of the Above

325. This type of control monitors the level of water on the top of the filter and attempts to control this level from the start of the operation to the end. This is accomplished by the controller operating a valve on the \_\_\_\_\_.

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

326. The valve will be nearly closed at the start of the filter run and fully open at the end. This design is used when the \_\_\_\_\_ or pressure on the filter is limited.

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

327. Both controllers consist of a venturi tube or some other type of metering device, as well as a valve to control the flow from the filter. In most cases, the valve is controlled by an automatic control device, often an air-actuated type valve that is controlled by the \_\_\_\_\_.

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

Loss of head indicator

328. 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. All of the above except B
- F. None of the Above

329. The \_\_\_\_\_ 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. All of the above except D
- F. None of the Above

330. 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
- E. All of the above except C
- F. None of the Above

In-line Turbidimeter

331. \_\_\_\_\_ in water is caused by small suspended particles that scatter or reflect light so that the water appears to be cloudy.

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

332. \_\_\_\_\_ of the filtered water may shelter bacteria, preventing chlorine from reaching it during the final disinfection process.

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

333. The \_\_\_\_\_ of the filtered water is one of the factors that determine the length of a filter run. At some point, the suspended material will start to break through the filter media and increase the turbidity of the filter effluent. At this time, the filter should be backwashed.

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

334. Continuous \_\_\_\_\_ 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. Shelter bacteria
- B. Suspended material
- C. Turbidity
- D. All of the above except A
- E. None of the above

335. \_\_\_\_\_ measurements will also indicate whether the coagulation and other treatment processes are operating properly.

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

#### Filtration Process

336. Water from the source or, more commonly, from \_\_\_\_\_, 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. Shelter bacteria
- B. Suspended material
- C. Pre-treatment processes
- D. Floc
- E. All of the above except A
- F. None of the Above

337. When the filtration is started after being backwashed, there will be little head loss. In filters with a control valve installed on the filter effluent pipe, the \_\_\_\_\_ is restricted during this time.

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

338. The control valve also has the important function of preventing filter surges, which could disturb the media and force \_\_\_\_\_ through the filter.

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

339. The rate of \_\_\_\_\_ on a filter depends on the type of filter. 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. Shelter bacteria
- B. Suspended material
- C. Turbidity
- D. Flow
- E. None of the Above

340. A \_\_\_\_\_ is almost fully closed when a filter is clean so that the desired water level on top of the filter is maintained.

- A. Headloss
- B. Constant rate flow valve
- C. Flow restrictor
- D. Backwash cycle
- E. All of the Above
- F. None of the Above

341. As the filter becomes dirty with suspended material, the valve opens gradually until the increase in the water level above the filter indicates that the filter needs \_\_\_\_\_.

- A. Headloss
- B. Flow redistributes
- C. Flow restrictor
- D. Backwashing
- E. All of the Above
- F. None of the Above

342. In filters with \_\_\_\_\_, the filters are allowed to take on as much water as they can handle. As the filters become dirty, both the headloss and the depth of the water on the surface increase until the filters need backwashing.

- A. Headloss
- B. Variable declining rate flow control
- C. Flow restrictor
- D. Backwash cycle
- E. All of the Above
- F. None of the Above

343. This method is generally preferred because it requires less operator attention. With this method, a \_\_\_\_\_ accepts as much flow as it can handle.

- A. Headloss calculation
- B. Filter
- C. Flow restrictor
- D. Backwash cycler
- E. All of the Above
- F. None of the Above

344. 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. All of the Above
- F. None of the Above

345. A \_\_\_\_\_ is placed in the filter effluent pipe to prevent a filter inflow that is too great for the filter.

- A. Headloss deflector
- B. Flow redistributor
- C. Flow restrictor
- D. Backwash cycler
- E. All of the Above
- F. None of the Above

346. Regardless of the method of control, 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. Headloss
- B. Flow redistributes
- C. Flow restrictor
- D. Backwashed
- E. All of the Above
- F. None of the Above

#### Back Washing

347. Proper backwashing is a very important step in the operation of a filter. If the filter is not \_\_\_\_\_ completely, it will eventually develop additional operational problems.

- A. Mudballed
- B. Flow redistributed
- C. Flow restricted
- D. Backwashed
- E. All of the Above
- F. None of the Above

348. If a filter is to operate efficiently, it must be cleaned before the next filter run. Treated water from storage is used for the \_\_\_\_\_. This treated water is generally taken from elevated storage tanks or pumped in from the clear well.

- A. Headloss
- B. Floc
- C. Flow restrictor
- D. Backwash cycle
- E. All of the Above
- F. None of the Above

349. During filtration, the filter media becomes coated with the \_\_\_\_\_, which plugs the voids between the filter grains, making the filter difficult to clean. The media must be expanded to clean the filter during the backwash.

- A. Headloss
- B. Floc
- C. Flow restrictor
- D. Backwash cycle
- E. All of the Above
- F. None of the Above

350. This expansion causes the filter grains to violently rub against each other, dislodging the \_\_\_\_\_ from the media.

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

351. The filter backwash rate has to be great enough to expand and agitate the filter media and suspend the \_\_\_\_\_ in the water for removal.

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

352. If the filter \_\_\_\_\_ is too high, media will be washed from the filter into the troughs and out of the filter. A normal backwash rate is between 12 to 15 gpm per square foot of filter surface area.

- A. Headloss
- B. Floc(s)
- C. Air wash
- D. Backwash rate
- E. All of the Above
- F. None of the Above

353. In most cases the filter backwash rate will not break up the mass on the top of the filter. The design engineer will recommend the installation of a surface wash of some type, the most common being a set of \_\_\_\_\_ that are suspended above the media during filtration.

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

354. During filter backwash, the media expands upwards and around the washing arms. A newer method of surface wash involves using \_\_\_\_\_ before the water wash. This is a very efficient method, but requires the installation of a large air blower to produce the air.

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

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

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

356. The filter should be backwashed when the following conditions have been met: The \_\_\_\_\_ is so high that the filter no longer produces water at the desired rate.

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

357. \_\_\_\_\_ starts to break through the filter and the turbidity in the filter effluent increases; and/or a filter run reaches a given hour of operation.

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

358. If a filter is taken out of service for some reason, it must always be \_\_\_\_\_ prior to be putting on line.

- A. Headloss
- B. Floc(s)
- C. Air wash
- D. Backwashed
- E. All of the Above
- F. None of the Above

359. The decision to backwash the filter should not be based on only one of the above conditions. If a filter is not backwashed until the \_\_\_\_\_ exceeds a certain number of feet, the turbidity may break through and cause the filter to exceed the standard of 0.5 NTU of turbidity.

- A. Headloss
- B. Floc(s)
- C. Air wash
- D. All of the Above
- E. None of the above

360. Similarly, depending on filter effluent- turbidity alone can cause high head loss and decreased filter flow rate, which can cause the pressure in the filter to drop below atmospheric pressure and cause the filter to \_\_\_\_\_ and stop filtering.

- A. Prevent headloss
- B. Air bind
- C. Assist the backwash cycle
- D. All of the Above
- E. None of the above

361. If the water applied to a filter is very good quality, the filter runs can be very long. Some filters can operate longer than one week before needing to be \_\_\_\_\_.

- A. Adjusting
- B. Floc(s)
- C. Air washed
- D. Backwashed
- E. All of the Above
- F. None of the Above

362. This is not recommended as long filter runs can cause the filter media to pack down so that it is difficult to \_\_\_\_\_ during the backwash.

- A. Control headloss
- B. Control floc(s)
- C. Expand the bed
- D. Backwash cycle
- E. All of the Above
- F. None of the Above

#### Backwashing Process

363. The normal method for \_\_\_\_\_ involves draining the water level above the filter to a point six inches above the filter media.

- A. Removing to suspended material trapped in the filter
- B. Backwashing a filter
- C. Allowing backwash water
- D. Opening the filter backwash valve
- E. All of the Above
- F. None of the Above

364. The surface wash is then turned on and allowed to operate for several minutes to break up the \_\_\_\_\_.

- A. Suspended material trapped in the filter
- B. Draining the water level
- C. Crust on the filter
- D. Filter backwash
- E. All of the Above
- F. None of the Above

365. The backwash valve is opened, allowing backwash water to start flowing into the filter and start \_\_\_\_\_.

- A. Carrying suspended material away from the filter
- B. Draining the water level
- C. Allowing backwash water
- D. Filter backwashing
- E. All of the Above
- F. None of the Above

366. For a filter with an air wash instead of a water-surface wash, the filter backwash water and the air wash should not be used together. This would be possible only if \_\_\_\_\_ is installed.

- A. Suspended materials are trapped in the filter
- B. Some means of controlling the media carryover
- C. Allowing backwash
- D. Filter backwash valve is fully opened
- E. All of the Above
- F. None of the Above

367. The time elapsed from when the filter wash is started until full flow is applied to the filter should be greater than one minute. After a few minutes, the \_\_\_\_\_ to allow full expansion of the filter media.

- A. Removal to suspended material trapped in the filter
- B. Draining the water level
- C. Allowing backwash water
- D. Filter backwash valve should be fully opened
- E. All of the Above
- F. None of the Above

368. Generally, this expansion will be from 20 to 40 percent over the normal filter bed volume. The expansion needed will depend on how much agitation is needed to suspend the filter media to \_\_\_\_\_.

- A. Remove to suspended material trapped in the filter
- B. Drain the water level
- C. Backwash water
- D. Filter the backwash
- E. All of the Above
- F. None of the Above

369. 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. The filter will be washed for 10 to 15 minutes, \_\_\_\_\_.

- A. If backwash water is used
- B. Depending on the amount of solids that must be removed
- C. Entering the plant
- D. Must not be allowed to enter the head of the plant
- E. None of the Above

370. The best way to determine how long the filter should be washed is to measure the turbidity of the \_\_\_\_\_. In most cases, a filter is washed too long. This could be costly.

- A. Backwash water is used
- B. Backwash water leaving the filter
- C. Raw water flow entering the plant
- D. Head of the plant
- E. All of the Above
- F. None of the Above

371. \_\_\_\_\_, and it must be treated after use. Backwash valves must be opened slowly.

- A. Backwash water is used
- B. Depending on the amount of solids that must be removed
- C. Raw water flow entering the plant
- D. Too much backwash water is used
- E. All of the Above
- F. None of the Above

372. Opening the valves too rapidly can cause \_\_\_\_\_, filter gravel, and filter media.

- A. Serious damage to the filter underdrain
- B. Depending on the amount of solids that must be removed
- C. Raw water flow entering the plant
- D. Must not be allowed to enter the head of the plant
- E. All of the Above
- F. None of the Above

#### Disposal of Filter Backwash Water

373. Water from the filter backwash cannot be returned directly to the environment. Normally the water is \_\_\_\_\_.

- A. Used
- B. Depending upon on the amount of solids that must be removed
- C. Discharged into a backwash tank and allowed to settle
- D. Allowed to enter the head of the plant
- E. All of the Above
- F. None of the Above

374. The supernatant, or cleared liquid, is then pumped back to the head of the treatment plant at a rate not exceeding ten percent of the \_\_\_\_\_.

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

375. 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. Backwash water is used
- B. Depending on the amount of solids that must be removed
- C. Raw water flow entering the plant
- D. Eliminates the need to obtain
- E. All of the Above
- F. None of the Above

376. Since backwash is a very high flow operation, the surges that are created from the backwash coming from the filter \_\_\_\_\_.

- A. Is used
- B. Depending on the amount of solids that must be removed
- C. Raw water flow entering the plant
- D. Must not be allowed to enter the head of the plant
- E. All of the Above
- F. None of the Above

377. The spent backwash water must be \_\_\_\_\_ and returned slowly to the treatment process.

- A. Used
- B. Removed
- C. Entering the plant
- D. Stored in storage tanks
- E. All of the Above
- F. None of the Above

#### Filter to Waste

378. When filtration is started after backwash, \_\_\_\_\_ until the turbidity in the effluent meets standards. Depending on the type of filter, this may last from two to 20 minutes.

- A. Backwash water is used
- B. Filtered water should be wasted
- C. Raw water flow entering the plant
- D. Returned
- E. All of the Above
- F. None of the Above

379. Wasting is needed as some \_\_\_\_\_ following the backwash. The media needs to become somewhat sticky again to start to capture the suspended material.

- A. Backwash water is okay
- B. Amount of solids
- C. Raw water
- D. Suspended material remains in the filter media
- E. All of the Above
- F. None of the Above

380. The filtration rate is higher in a clean filter, causing more material to be swept from the filter during the start-up. \_\_\_\_\_ slowly after a backwash to prevent breakthrough of suspended material.

- A. Backwash water is used
- B. Filtration should always be started
- C. Raw water flow entering the plant
- D. Storing in storage tanks
- E. All of the Above
- F. None of the Above

#### Filter Aids

381. Sometimes, when water passes through a filter, the \_\_\_\_\_ into smaller particles that will penetrate deeply into the filter media, causing premature turbidity breakthrough.

- A. Filter media
- B. Polymers
- C. Filter backwashing of the filter
- D. Filter aid
- E. All of the Above
- F. None of the Above

382. This will require more frequent \_\_\_\_\_ of the filter and use of large volumes of backwash water to be able to remove the floc that has penetrated deeply into the filter bed.

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

383. A \_\_\_\_\_ is a material that adds strength to the floc and prevents its breakup. Generally, a polymer is used as a filter aid because it creates strong bonds with the floc.

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

384. \_\_\_\_\_ are water-soluble, organic compounds that can be purchased in either wet or dry form.

- A. Filter medias
- B. Polymers
- C. Filters
- D. Filter aids
- F. None of the Above

385. \_\_\_\_\_ have very high molecular weight and cause the floc to coagulate and flocculate quickly.

- A. Filter media
- B. Polymers
- C. Coagulants
- D. Filter aid
- E. All of the Above
- F. None of the Above

386. Polymers can have positive or negative charges, depending on the type needed to cause attraction to the specific \_\_\_\_\_.

- A. Filter media
- B. Polymers
- C. Filter backwashing of the filter
- D. Filter aid
- E. All of the Above
- F. None of the Above

387. When used as a \_\_\_\_\_, the polymer strengthens the bonds and prevents the shearing forces in the filter from breaking the floc apart.

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

388. For best results, the \_\_\_\_\_ should be added just ahead of the filter. A normal dose of polymer for filter aiding will be less than 0.1 ppm, but the exact dose will be decided by the result of a jar test and by experimentation in the treatment plant.

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

389. Too much \_\_\_\_\_ will cause the bonds to become too strong, which may then cause the filter to plug, especially the top few inches of the filter media.

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

#### Filter Operating Problems

390. 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. All of the Above
- E. None of the above

#### Chemical Treatment before the Filter

391. The \_\_\_\_\_ of the water treatment must be monitored continuously.

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

392. 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. Maximum headloss
- C. Filter media
- D. Turbidity breakthrough
- E. All of the Above
- F. None of the Above

393. If there is early turbidity breakthrough in the filter effluent, more coagulant may have to be added to the coagulation process. There may be a need for better mixing during the coagulation or the addition of more \_\_\_\_\_.

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

394. If there is a rapid increase in filter head loss, too much coagulant may be clogging the filter. Less coagulant or less \_\_\_\_\_ should be used. The operator needs to learn to recognize these problems and choose the proper corrections.

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

#### Control of Filter Flow Rate

395. When a filter is subjected to rapid changes in flow rate, the turbidity of the effluent may be affected; the dirtier the \_\_\_\_\_, the greater the effect.

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

396. When a plant flow changes, the \_\_\_\_\_ also has to change to produce the water needed. If an increase is necessary, the flow should, if possible, be increased gradually over a ten-minute period to reduce the impact on the filter.

- A. Filter aid
- B. Coagulation and flocculation stages
- C. Filter media
- D. Filter flow
- E. All of the Above
- F. None of the Above

397. Addition of filter aids may also reduce the impact on the filter effluent. When backwashing a filter and therefore temporarily taking it out of service, the remaining filter(s) must pick up the additional flow. This can cause an abrupt change in flow that will cause \_\_\_\_\_.

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

398. This problem can be avoided by keeping one filter in reserve to accept this additional flow. If the plant has a \_\_\_\_\_, this will also prevent surges to the filters.

- A. Filter helper
- B. Coagulation and flocculation process
- C. Backwash storage basin
- D. Turbidity breakthrough measuring device
- E. All of the Above
- F. None of the Above

399. Many plants are not operated continuously, and the start-up at the beginning of the day will cause a \_\_\_\_\_.

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

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

- A. Process water
- B. Effluent
- C. Raw water
- D. Turbidity
- E. All of the Above
- F. None of the Above

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