

**Registration form**

**Wastewater Treatment 303 Training Course \$200.00  
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

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

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

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

Address: \_\_\_\_\_

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Phone:  
Home (\_\_\_\_\_) \_\_\_\_\_ Work (\_\_\_\_\_) \_\_\_\_\_

Operator ID# \_\_\_\_\_ Exp Date \_\_\_\_\_

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

Wastewater Treatment \_\_\_\_\_ Other \_\_\_\_\_

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

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

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## **DISCLAIMER NOTICE**

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

**State Approval Listing Link**, check to see if your State or Agency accepts or has pre-approved this course. Not all States are listed. Not all courses are listed.

**Professional Engineers**; Most states or agencies 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 from TLC for an additional \$69.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

**All downloads are electronically tracked and monitored for security purposes.**

# Wastewater Treatment 303 CEU Course Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

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

*Method of Course acceptance confirmation. Please fill this section*

Website \_\_ Telephone Call \_\_ Email \_\_\_\_ Spoke to \_\_\_\_\_

Did you receive the approval number if Applicable? \_\_\_\_\_

What is the approval number if Applicable? \_\_\_\_\_

*You are responsible to ensure that TLC receives the Assignment and Registration Key. Please call us to ensure that we received it.*

*You can use Adobe Acrobat DC Program to complete the assignment.*

*Please circle, underline, bold or X only one correct answer*

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**Additional certificate for another Agency – additional fee \$50**

**Please fax the answer key to TLC  
(928) 272-0747**

**Always call to confirm that we received your paperwork.**



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

**WASTEWATER TREATMENT 303  
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.***

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

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

Very Similar 0 1 2 3 4 5 Very Different

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

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

## Wastewater Treatment 303 CEU Course Assignment

*The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit [www.ABCTLC.com](http://www.ABCTLC.com) and download the assignment and e-mail it back to TLC.*

You will have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to [info@tlch2o.com](mailto:info@tlch2o.com).

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

### Clean Water Act (Rule) Summary

#### 33 U.S.C. s/s 1251 et seq. (1977)

1. The Clean Water Act is a 1977 amendment to the \_\_\_\_\_, which set the basic structure for regulating discharges of pollutants to waters of the United States.
  - A. Clean Water Act or CWA
  - B. Federal Water Pollution Control Act of 1972
  - C. Clean water legislation
  - D. EPA
  - E. Valuable wetlands
  - F. None of the Above
2. Which of the following terms gave the authority to set effluent standards on an industry basis and continued the requirements to set water quality standards for all contaminants in surface waters?
  - A. Clean Water Act or CWA
  - B. EPA
  - C. Congress
  - D. Water quality standard(s)
  - E. Public notification program(s)
  - F. None of the Above
3. Which of the following terms primary objective is to restore and maintain the integrity of the nation's waters?
  - A. Clean Water Act
  - B. Water quality levels
  - C. Clean water legislation
  - D. EPA still retains oversight responsibilities
  - E. Valuable wetlands and other aquatic habitats
  - F. None of the Above
4. Which of the following terms has clarified and expanded permit requirements under the Clean Water Act for 19,000 municipal sanitary sewer collection systems in order to reduce sanitary sewer overflows?
  - A. Clean Water Act or CWA
  - B. Water quality levels
  - C. Clean water legislation
  - D. EPA still retains oversight responsibilities
  - E. Environmental Protection Agency (EPA)
  - F. None of the Above

5. The requirements will help communities improve some of water quality standards—by requiring facilities to develop and implement new capacity, management, operation, and maintenance programs and public notification programs.

A. True B. False

6. The CWA makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit (NPDES) is obtained under the?

A. Act D. EPA  
B. Water quality levels E. OSHA  
C. Clean water legislation F. None of the Above

7. Which of the following terms focused on toxic pollutants?

A. Clean Water Act or CWA D. Water quality standard(s)  
B. EPA E. The 1977 amendments  
C. Congress F. None of the Above

8. The CWA provisions for the delegation by \_\_\_\_\_ of many permitting, administrative, and enforcement aspects of the law to state governments. In states with the authority to implement CWA programs, the EPA still retains oversight responsibilities.

A. Clean Water Act or CWA D. EPA  
B. Water quality levels E. Valuable wetlands and other aquatic habitats  
C. Clean water legislation F. None of the Above

9. Which of the following terms is the primary federal law that protects our nation's waters, including lakes, rivers, aquifers, and coastal areas?

A. Clean Water Act D. Water quality standard(s)  
B. EPA E. Public notification program(s)  
C. Congress F. None of the Above

10. Which of the following terms focuses on improving the quality of the nation's waters?

A. Clean Water Act D. Water quality standard(s)  
B. EPA E. Public notification program(s)  
C. Congress F. None of the Above

11. Which of the following terms requires major industries to meet performance standards to ensure pollution control, charges states and tribes with setting specific water quality criteria appropriate for their waters and developing pollution control programs?

A. Clean Water Act D. EPA still retains oversight responsibilities  
B. Water quality levels E. Valuable wetlands and other aquatic habitats  
C. Clean water legislation F. None of the Above

### **The Future**

12. All Americans will enjoy clean water that is safe for fishing and swimming. We will achieve a net gain of wetlands by preventing additional losses and restoring hundreds of thousands of acres of wetlands.

A. True B. False

## Basic Wastewater Treatment Processes

### Physical

13. Physical processes were some of the earliest methods to remove solids from wastewater, usually by passing wastewater through screens to remove debris and solids. In addition, solids that are heavier than water will settle out from wastewater by gravity.

A. True B. False

14. In wastewater treatment, particles along with \_\_\_\_\_, will float to the top of water and can also be removed?

- A. Biosolid(s)
- B. Activated Sludge
- C. Chemical(s)
- D. Organic material
- E. Entrapped air
- F. None of the Above

### Biological

15. The bacteria normally present in wastewater must have oxygen to do their part in breaking down the sewage.

A. True B. False

16. According to the text, excess microbiological growth could be removed from the wastewater by physical processes.

A. True B. False

17. Which of the following wastewater terms means is a suspended growth process for removing organic matter from sewage by saturating it with air and microorganisms that can break down the organic matter?

- A. Biosolid(s)
- B. Activated Sludge
- C. Chemical(s)
- D. Organic material
- E. Entrapped air
- F. None of the Above

18. Which of the following wastewater terms involves treatment levels beyond secondary treatment?

- A. Oxygen
- B. Carbon dioxide
- C. Gravity
- D. Advanced Treatment
- E. Physical separation step
- F. None of the Above

19. Bacteria and other small organisms in wastewater consume organic matter in sewage, turning it into new bacterial cells, \_\_\_\_\_, and other by-products.

- A. Oxygen
- B. Carbon dioxide
- C. Gravity
- D. Secondary treatment
- E. Physical separation step
- F. None of the Above

20. To remove organic material from wastewater, Scientists observed that \_\_\_\_\_ could be contained and accelerated in systems.

- A. These natural processes
- B. Activated Sludge
- C. Chemical(s)
- D. Organic material
- E. Entrapped air
- F. None of the Above

21. Masses of microorganisms grow and rapidly metabolize organic pollutants because of the addition of \_\_\_\_\_ to wastewater.

- A. Oxygen
- B. Carbon dioxide
- C. Gravity
- D. Secondary treatment
- E. Physical separation step
- F. None of the Above

### Chemical

22. Which of the following wastewater terms such as alum, lime or iron salts can be added to wastewater to cause certain pollutants, to floc or bunch together into large, heavier masses that can be removed faster through physical processes?

- A. Biosolid(s)
- B. Activated Sludge
- C. Simple chemicals
- D. Organic material
- E. Entrapped air
- F. None of the Above

23. The chemical industry has developed \_\_\_\_\_ known as polymers to improve the physical separation step in wastewater treatment.

- A. Oxygen
- B. Carbon dioxide
- C. Gravity
- D. Secondary treatment
- E. Synthetic inert chemicals
- F. None of the Above

24. Which of the following wastewater terms are often used at the later stages of treatment to improve the settling of excess microbiological growth or biosolids?

- A. Biosolid(s)
- B. Activated Sludge
- C. Chemical(s)
- D. Organic material
- E. Polymers
- F. None of the Above

25. According to the text, chemicals can be used to create changes in pollutants that increase the removal of these new forms by physical processes.

- A. True
- B. False

### Organic Matter

26. Which of the following wastewater terms can cause pollution- too much organic matter in wastewater can be devastating to receiving waters?

- A. Long chained compounds
- B. Biodegradable material(s)
- C. Organic material(s)
- D. Wastewater-related source(s)
- E. Supply of oxygen
- F. None of the Above

27. Large amounts of biodegradable materials can reduce or deplete \_\_\_\_\_ in the water needed by aquatic life.

- A. Outbreaks of these diseases
- B. Supply of oxygen
- C. Organic compound(s)
- D. Graywater and blackwater
- E. Oxygen
- F. None of the Above

28. One of the measurements used to assess overall wastewater strength, the amount of oxygen organisms needed to break down wastes in wastewater is referred to as the?

- A. Biochemical oxygen demand (**BOD**)
- B. Biodegradable material(s)
- C. Organic material(s)
- D. Wastewater-related source(s)
- E. Oxygen
- F. None of the Above

29. Some organic compounds are more stable than others and cannot be quickly broken down by organisms this is true of \_\_\_\_\_ developed for agriculture and industry.

- A. Most inorganic substances
- B. Organic material(s)
- C. Organic compound(s)
- D. Graywater and blackwater
- E. Many synthetic organic compounds
- F. None of the Above

30. Which of the following wastewater terms are toxic to humans, fish, and aquatic plants and often are disposed of improperly in drains or carried in stormwater?

- A. BOD
- B. Most inorganic substances
- C. Nitrogen and phosphorus
- D. Pesticides and herbicide(s)
- E. Turbidity
- F. None of the Above

31. Two toxic \_\_\_\_\_ like benzene and toluene are found in some solvents, pesticides, and other products.

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. Excessive grease
- E. Organic compounds
- F. None of the Above

### Oil and Grease

32. Fatty organic materials from animals, vegetables, and petroleum are quickly broken down by bacteria and can cause pollution in receiving environments.

- A. True
- B. False

33. Which of the following wastewater terms also adds to the septic tank scum layer, causing more frequent tank pumping to be required?

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. Excessive grease
- E. Nitrogen and phosphorus
- F. None of the Above

34. Which of the following wastewater terms used for motors and industry are considered hazardous waste and should be collected and disposed of separately from wastewater?

- A. BOD
- B. Most inorganic substances
- C. Nitrogen and phosphorus
- D. Pesticides and herbicide(s)
- E. Petroleum-based waste oil(s)
- F. None of the Above

35. When large amounts of oils and greases are discharged, these increase \_\_\_\_\_ and they may float to the surface and harden, causing aesthetically unpleasing conditions.

- A. BOD
- B. Most inorganic substances
- C. Nitrogen and phosphorus
- D. Nitrogen and phosphorus
- E. Petroleum-based waste oil(s)
- F. None of the Above

### Inorganics

36. Which of the following wastewater terms are relatively stable, and cannot be broken down easily by organisms in wastewater?

- A. Metals
- B. Most inorganic substances
- C. Nitrogen and phosphorus
- D. Pesticides and herbicide(s)
- E. Petroleum-based waste oil(s)
- F. None of the Above

37. Extra treatment steps are often required to remove \_\_\_\_\_ from industrial wastewater sources.

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. BOD
- E. DON
- F. None of the Above

38. According to the text, heavy metals can be discharged with many types of industrial wastewaters are difficult to remove by conventional treatment methods.

- A. True
- b. False

39. Which of the following wastewater terms - metals, and compounds, such as sodium, potassium, calcium, magnesium, cadmium, copper, lead, nickel, and zinc are common in wastewater from both residential and nonresidential sources?

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. Excessive grease
- E. Pesticides and herbicide(s)
- F. None of the Above

### Nutrients

40. Normally, excessive nutrients in receiving waters cause algae and other plants to grow quickly adding oxygen in the water, because of this additional of oxygen, fish and other aquatic life thrive.

- A. True
- B. False

41. Which of the following wastewater terms have also been linked to ocean "red tides" that poison fish and cause illness in humans?

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. Excessive grease
- E. Nitrogen and phosphorus
- F. None of the Above

42. Which of the following wastewater terms in drinking water may contribute to miscarriages and is the cause of a serious illness in infants called methemoglobinemia or "blue baby syndrome."

- A. BOD
- B. Most inorganic substances
- C. Phosphorus
- D. Pesticides and herbicide(s)
- E. Nitrogen
- F. None of the Above

43. According to the text, wastewater often contains large amounts of \_\_\_\_\_ in the form of nitrate and phosphate, which promote plant growth.

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. Nutrients nitrogen and phosphorus
- E. Nitrogen and phosphorus
- F. None of the Above

44. Organisms only require small amounts of \_\_\_\_\_ in biological treatment, so there normally is an excess available in treated wastewater.

- A. BOD
- B. Most inorganic substances
- C. Nitrogen and phosphorus
- D. Microorganisms
- E. Nutrients
- F. None of the Above



## Solids

45. Which of the following terms must be treated, or they will clog soil absorption systems or reduce the effectiveness of disinfection systems?

- A. BOD
- B. Organic material
- C. The solids
- D. Microorganisms
- E. Suspended solids in wastewater
- F. None of the Above

46. Which of the following terms represents small particles of certain wastewater materials can dissolve, like salt in water?

- A. Suspended solids
- B. Organic material
- C. The solids
- D. Microorganisms
- E. Dissolved solids
- F. None of the Above

47. Solid materials in wastewater can consist of \_\_\_\_\_ and organisms.

- A. BOD
- B. Organic material
- C. The solids
- D. Microorganisms
- E. Organic and/or inorganic materials
- F. None of the Above

48. The solids must be significantly reduced by treatment or they can increase which of the following terms when discharged to receiving waters?

- A. Suspended solids
- B. Organic material
- C. BOD
- D. Microorganisms
- E. Dissolved solids
- F. None of the Above

49. Settleable solids: Certain substances, such as sand, grit, and oxygen-demanding substances settle out from the rest of the wastewater stream during the preliminary stages of treatment.

- A. True
- B. False

50. On the bottom of settling tanks and ponds, \_\_\_\_\_ makes up a biologically active layer of sludge that aids in treatment.

- A. BOD
- B. Organic material
- C. The solids
- D. Heavier organic and inorganic materials
- E. Suspended solids in wastewater
- F. None of the Above

51. Which of the following terms represents materials that resist settling may remain suspended in wastewater?

- A. Suspended solids
- B. Organic material
- C. The solids
- D. Microorganisms
- E. Dissolved solids
- F. None of the Above

52. Some dissolved materials are consumed by \_\_\_\_\_ in wastewater.

- A. BOD
- B. Organic material
- C. The solids
- D. Microorganisms
- E. Suspended solids in wastewater
- F. None of the Above

53. Excessive amounts of dissolved solids in wastewater can have adverse effects on the environment.

- A. True
- B. False

## Gases

54. Certain gases in wastewater can cause odors, affect treatment, or are potentially dangerous.

- A. True    B. False

55. Methane gas is a byproduct of this wastewater term and is highly combustible.

- A. Dissolved oxygen                      D. Biochemical oxygen demand or BOD  
B. Oxygen-demanding                      E. Anaerobic biological treatment  
C. Magnesium hydroxide                      F. None of the Above

## Hydrogen Sulfide and Ammonia

56. The gases hydrogen sulfide and along with this substance can be toxic and pose asphyxiation hazards.

- A. Ammonia                                      D. The lack of oxygen  
B. Wastewater odor(s)                      E. Less oxygen  
C. Hydrogen sulfide or H<sub>2</sub>S problem(s)    F. None of the Above

57. Ammonia as a dissolved gas in wastewater is not dangerous to fish.

- A. True    B. False

58. The best method of controlling hydrogen sulfide is to eliminate its habitat or growth area by keeping sewers cleaner. This action will harbor?

- A. Fewer slime bacteria                      D. The lack of oxygen  
B. Wastewater odor(s)                      E. Less oxygen  
C. Hydrogen sulfide or H<sub>2</sub>S problem(s)    F. None of the Above

59. Salts of zinc and iron may precipitate in to which term?

- A. Dissolved oxygen                      D. Biochemical oxygen demand or BOD  
B. Sulfides                                      E. Wastewater odor(s)  
C. Magnesium hydroxide                      F. None of the Above

60. Which of the following terms will create conditions in the sewer system because of the lack of oxygen?

- A. Slime bacteria                      D. The lack of oxygen  
B. Wastewater odor(s)                      E. Less oxygen  
C. Hydrogen sulfide                      F. None of the Above

61. Unless effectively contained or minimized by design and location, wastewater odors can affect the mental well-being and?

- A. Dissolved oxygen                      D. Biochemical oxygen demand or BOD  
B. Oxygen-demanding                      E. Wastewater odor(s)  
C. Quality of life of residents                      F. None of the Above

62. Hydrogen dioxide production in collection systems can cause a number of problems such as corrosion of the pipes, manholes, and creation of hazardous atmospheres and foul odors.

- A. True    B. False

### **Pollutants, Oxygen-Demanding Substances**

63. Which of the following terms is a key element in water quality that is necessary to support aquatic life?

- A. Dissolved oxygen
- B. Oxygen-demanding
- C. Magnesium hydroxide
- D. Biochemical oxygen demand or BOD
- E. Wastewater odor(s)
- F. None of the Above

64. Biochemical oxygen demand, or BOD, is used to measure how well a sewage treatment plant is working, it is a demand placed on the unnatural supply of pollutants in wastewater.

- A. True
- B. False

65. If the effluent, the treated wastewater produced by a treatment plant, has a high content of organic pollutants or ammonia, it will demand more oxygen from the water and leave the water with less of \_\_\_\_\_ to support fish and other aquatic life.

- A. Slime bacteria
- B. Wastewater odor(s)
- C. Hydrogen sulfide or H<sub>2</sub>S problem(s)
- D. The lack of oxygen
- E. Oxygen
- F. None of the Above

66. Organic matter and which term are “oxygen-demanding” substances?

- A. Dissolved oxygen
- B. Ammonia
- C. Magnesium hydroxide
- D. Biochemical oxygen demand, or BOD
- E. Wastewater odor(s)
- F. None of the Above

67. According to the text, oxygen-demanding substances are contributed by which term and agricultural and industrial wastes.

- A. Slime bacteria
- B. Wastewater odor(s)
- C. Hydrogen sulfide or H<sub>2</sub>S problem(s)
- D. The lack of oxygen
- E. Domestic sewage
- F. None of the Above

68. Oxygen-demanding substances are usually destroyed or converted to other compounds by \_\_\_\_\_ if there is sufficient oxygen present in the water.

- A. Dissolved oxygen
- B. Oxygen-demanding
- C. Magnesium hydroxide
- D. Biochemical oxygen demand, or BOD
- E. Bacteria
- F. None of the Above

### **Pathogens**

69. According to the text, modern disinfection techniques have greatly reduced the danger of waterborne disease.

- A. True
- B. False

### **Nutrients**

70. Which of the following wastewater terms are essential to living organisms and are the chief nutrients present in natural water?

- A. Oxygen
- B. Ecology
- C. Nutrient enrichment
- D. Carbon, nitrogen, and phosphorus
- E. Phosphorus and nitrogen
- F. None of the Above

71. Uncontrolled algae growth blocks out sunlight and chokes aquatic plants and animals by depleting \_\_\_\_\_ in the water at night.

- A. Pathogen(s)
- B. Dissolved oxygen
- C. Nutrient enrichment
- D. Excessive growth of algae
- E. Phosphorus and nitrogen
- F. None of the Above

72. According to the text, the release of nutrients in quantities that exceed the affected waterbody's ability to assimilate them results in a condition called?

- A. Toxic
- B. Ecology
- C. Nutrient enrichment
- D. Eutrophication or cultural enrichment
- E. Oxygen and organic waste
- F. None of the Above

73. Which of the following wastewater terms do not remove the phosphorus and nitrogen to any substantial extent?

- A. Biofilm
- B. Some contaminants
- C. Secondary treatment
- D. Conventional secondary biological treatment processes
- E. Oxygen and organic waste
- F. None of the Above

74. According to the text, nutrients may convert the organic forms of these substances into mineral form, making them more usable by plant life.

- A. True
- B. False

75. An excess of these nutrients over-stimulates the growth of water plants, the result causes unsightly conditions, interferes with drinking water treatment processes, and causes unpleasant and disagreeable tastes and odors in drinking water.

- A. True
- B. False

76. Primarily \_\_\_\_\_ but occasionally nitrogen, causes nutrient enrichment which can result in excessive growth of algae.

- A. Phosphorus
- B. Heavy metals
- C. Nutrient enrichment
- D. Excessive growth of algae
- E. Phosphorus and nitrogen
- F. None of the Above

### **Inorganic and Synthetic Organic Chemicals**

77. Inorganic and Synthetic Organic Chemicals can cause \_\_\_\_\_ problems, and many are not effectively removed by conventional wastewater treatment.

- A. Toxic
- B. Ecology
- C. Nutrient enrichment
- D. Excessive growth of algae
- E. Taste and odor
- F. None of the Above

### **Thermal**

78. Which of the following terms reduces the capacity of water to retain oxygen?

- A. Heat
- B. Heavy metals
- C. Nutrient enrichment
- D. Excessive growth of algae
- E. Phosphorus and nitrogen
- F. None of the Above

79. Unchecked discharges of \_\_\_\_\_ can seriously alter the ecology of a lake, a stream, or estuary.

- A. Toxic
- B. Waste heat
- C. Nutrient enrichment
- D. Eutrophication or cultural enrichment
- E. Phosphorus and nitrogen
- F. None of the Above

80. According to the text, even discharges from wastewater treatment plants and storm water retention ponds affected by winter can be released at temperatures below that of the receiving water, and lower the stream temperature.

- A. True
- B. False

### Primary Treatment

81. The initial stage in the treatment of domestic wastewater is known as bar screens.

- A. True
- B. False

82. Coarse solids are removed from the wastewater in the primary stage of treatment. In some treatment plants, which missing term may be combined into one basic operation?

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Suspended growth process(es)
- E. Primary and secondary stages
- F. None of the Above

83. There are two basic stages in the treatment of wastes, RAS and WAS.

- A. True
- B. False

84. The secondary stage uses which term to further purify wastewater?

- A. Very fine solids
- B. Biological processes
- C. Pollutant(s)
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

### Preliminary Treatment

85. The Preliminary Treatment is a physical stage consisting of Coarse Screening, Raw Influent Pumping, Static Fine Screening, Grit Removal, and Selector Tanks.

- A. True
- B. False

86. Which of the following terms enters from the collection system into the Coarse Screening process?

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Raw wastewater
- E. Dissolved organic and inorganic constituents
- F. None of the Above

87. After the wastewater has been screened, it may flow into a grit chamber where sand, grit, cinders, and small stones settle to the bottom.

- A. True
- B. False

88. Especially in cities with combined sewer systems, removing the \_\_\_\_\_ that washes off streets or land during storms is very important.

- A. Very fine solids
- B. Grit and gravel
- C. Pollutant(s)
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

89. Large amounts of which term entering a treatment plant can cause serious operating problems, such as excessive wear of pumps and other equipment?

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Grit and sand
- E. Dissolved organic and inorganic constituents
- F. None of the Above

90. In some plants, another finer screen is placed after the grit chamber to remove any additional material that might damage equipment or interfere with later processes.

- A. True
- B. False

91. Which of the following terms then passes into the Static Fine Screening process which consists of two stationary screens?

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Flow
- E. Dissolved organic and inorganic constituents
- F. None of the Above

92. The wastewater passes into \_\_\_\_\_ a process that consists of two vortex grit separators that produce a whirlpool action to force the finest debris to the outside perimeter.

- A. Very fine solids
- B. De-gritted wastewater
- C. Grit Removal
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

93. Which of the following terms must be periodically collected and trucked to a landfill for disposal or are incinerated?

- A. Very fine solids
- B. Wastewater
- C. Pollutant(s)
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

94. The Coarse Screening consists of a basket shaped bar screen that collects larger debris (several inches in diameter) prior to the Raw Influent Pumping.

- A. True
- B. False

95. Which of the following terms is removed and placed into a dumpster for disposal into the landfill?

- A. Liquids
- B. Finer debris
- C. Compounds
- D. Debris
- E. Dissolved organic and inorganic constituents
- F. None of the Above

96. Which of the following terms passes into the Raw Influent Pumping process that consists of submersible centrifugal pumps?

- A. Wastewater
- B. Split samples
- C. Duplicate samples
- D. Dissolved organic and inorganic constituents
- E. Grit and gravel
- F. None of the Above

### **Primary Sedimentation**

97. Pollutants that are dissolved or are very fine and remain suspended in the wastewater are easily removed effectively by gravity settling.

- A. True
- B. False

98. When the wastewater enters a sedimentation tank, it slows down and the suspended solids gradually sink to the bottom, this mass of solids is called?

- A. Very fine solids
- B. Wastewater
- C. Pollutant(s)
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

99. When the screening completed and the grit removed, wastewater is clear of dissolved organic and inorganic constituents along with suspended solids.

- A. True
- B. False

100. Which of the following wastewater treatment terms consist of minute particles of matter that can be removed from the wastewater with further treatment such as sedimentation or gravity settling, chemical coagulation, or filtration?

- A. Solid(s)
- B. Suspended solids
- C. Grit and gravel
- D. Suspended growth process(es)
- E. Dissolved organic and inorganic constituents
- F. None of the Above

### **Secondary Treatment**

101. The wastewater enters from Preliminary Treatment into the clarifier process which is a biological process consisting of large oval shaped basins that are capable of removing finer solids.

- A. True
- B. False

102. Maintaining a population of microorganisms within the oxidation basins that consumes which missing term and adhere to the solids themselves?

- A. Total Solids
- B. TDS
- C. Very fine solids
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. Wastewater temperature
- F. None of the Above

103. Which of the following terms form larger and heavier aggregates that can be physically separated?

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Finer solids
- E. Dissolved organic and inorganic constituents
- F. None of the Above

104. After which term has been through Primary Treatment processes, it flows into the next stage of treatment called secondary?

- A. Very fine solids
- B. Wastewater
- C. Pollutant(s)
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

105. The two most common conventional methods used to achieve secondary treatment are: \_\_\_\_\_ and suspended growth processes.

- A. Solid(s)
- B. Finer debris
- C. Attached growth processes
- D. Unsuspended growth process(es)
- E. Organic matter
- F. None of the Above

106. The Secondary Treatment stage consists of a biological process such as which term and a physical process, Secondary Clarification?

- A. Wildlife habitat
- B. Oxidation Ditches
- C. Denitrification
- D. Phosphorus-reduction system(s)
- E. Excessive sludge production
- F. None of the Above

107. The Preliminary Treatment stage removes as much \_\_\_\_\_ as possible using physical processes.

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Suspended growth process(es)
- E. Dissolved organic and inorganic constituents
- F. None of the Above

### **Nutrient Removal Technologies**

#### **Fixed-film systems - Aerobic/anaerobic trickling filter package plant**

108. Which of the following terms are biological treatment processes that employ a medium such as rock, plastic, wood, or other natural or synthetic solid material that will support biomass on its surface?

- A. Trickling filter(s)
- B. Fixed-film systems (FFSs)
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

109. Which of the following terms are typically constructed as beds of media through which wastewater flows?

- A. A closed loop
- B. Nitrogen removal system(s)
- C. Optimal DO levels
- D. Trickling filter FFSs
- E. A portion of the denitrified effluent
- F. None of the Above

110. Which of the following terms represents removal typically varies from 0 to 35 percent although removal percentages as high as 65%?

- A. Nitrified effluent
- B. Nitrogen
- C. Total Nitrogen (TN)
- D. Nitrogen and phosphorus levels
- E. Activated sludge
- F. None of the Above

111. Phosphorus removal is typically 1 to 1.5 percent.

- A. True
- B. False

112. Multi-pass systems result in higher treatment quality and assist in removing \_\_\_\_\_ levels by promoting nitrification in the aerobic media bed and denitrification in the anaerobic septic tank.

- A. Total Solids
- B. TDS
- C. pH
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. Total Nitrogen (TN)
- F. None of the Above

113. According to the text, some of the factors affecting performance include influent wastewater characteristics, hydraulic and organic loading, medium type, maintenance of optimal DO levels, and?

- A. Wildlife habitat
- B. Recirculation rates
- C. Denitrification
- D. Phosphorus-reduction system(s)
- E. Excessive sludge production
- F. None of the Above



114. Commercial on-site systems use synthetic media and receive wastewater from overlying sprayheads for anaerobic treatment and de-nitrification.

A. True B. False

115. Which of the following terms returns to the anoxic zone to mix with either septic tank contents or incoming septic tank effluent for denitrification?

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Nitrified effluent
- E. Biosurfactant trehalose
- F. None of the Above

116. Which of the following terms is discharged for disposal or further treatment?

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. Denitrified effluent
- E. Oxygen demand of wastewater
- F. None of the Above

117. According to the text, currently typical trickling filters systems are capable of producing effluent \_\_\_\_\_ concentrations of 5 to 40 mg/L.

- A. Nitrified effluent
- B. Nitrogen
- C. Total Nitrogen (TN)
- D. Nitrogen and phosphorus levels
- E. BOD and TSS
- F. None of the Above

### **Sequencing batch reactor (SBR)**

118. According to the text, the SBR process is a sequential suspended growth process in which all major steps occur in the same tank in sequential order.

A. True B. False

119. Which of the following terms consists of a combination of level sensors, timers, and microprocessors which can be configured to meet the needs of the system?

- A. SBR process
- B. Underdrain system
- C. Sand filter(s)
- D. Cluster applications
- E. Process control timer(s)
- F. None of the Above

120. Which of the following terms can be designed and operated to enhance removal of nitrogen, phosphorus, and ammonia, in addition to removing TSS and BOD?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. SBRs
- E. Recirculating sand filters (RSFs)
- F. None of the Above

121. Which of the following terms are suitable for areas with little land, stringent treatment requirements, and small wastewater flows such as RV parks, and other small applications?

- A. Package plant SBRs
- B. Sand filter(s)
- C. Chemical adsorption
- D. Fixed-film bioreactor(s)
- E. Diffused air or mechanical devices
- F. None of the Above

122. The SBR system can typically be found in packaged configurations for onsite and small community or?

- A. Decanter
- B. Underdrain system
- C. Sand filter(s)
- D. Cluster applications
- E. Process control timer(s)
- F. None of the Above

123. Which of the following terms are often sized to provide mixing as well and are operated by the process control timers?

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. SBRs
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

124. Several decanter configurations are available, including?

- A. Fixed and floating units
- B. Recirculating filter(s)
- C. Available adsorption sites
- D. Septic tank effluent
- E. Distribution network
- F. None of the Above

### **Intermittent Sand Filters (ISF)**

125. Intermittent sand filters (ISF) is used to describe a variety of Packed-bed filters of sand or other granular materials available on the market.

- A. True
- B. False

126. Which of the following terms provide advanced secondary treatment of settled wastewater or septic tank effluent?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Sand filters
- D. Aerobic nitrification filters
- E. Recirculating sand filters (RSFs)
- F. None of the Above

127. Which of the following terms collects the filter effluent for further processing or discharge?

- A. SBR process
- B. Underdrain system
- C. Sand filter(s)
- D. Distribution network
- E. Process control timer(s)
- F. None of the Above

128. Which of the following terms are aerobic, fixed-film bioreactors?

- A. Decanter
- B. Sand filter(s)
- C. Chemical adsorption
- D. Fixed-film bioreactor(s)
- E. Diffused air or mechanical devices
- F. None of the Above

129. Bioslimes from the growth of microorganisms develop as films on the sand particle surfaces. The microorganisms in the slimes capture soluble and colloidal waste materials in the wastewater as it percolates over the sand surfaces.

- A. True
- B. False

130. Which of the following terms are strained out at the filter surface?

- A. Total Solids
- B. TDS
- C. Most suspended solids
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. Wastewater temperature
- F. None of the Above

131. Which of the following terms are usually limited, the capacity of the media to retain ions depends on the target constituent, the pH, and the mineralogy of the media?

- A. Decanter
- B. Sand filter(s)
- C. Chemical adsorption
- D. Fixed-film bioreactor(s)
- E. Adsorption sites in the media
- F. None of the Above

132. Phosphorous is one element of concern in wastewater that can be removed in this manner, but the number of available adsorption sites is limited by the?

- A. Characteristics of the media
- B. Recirculating filter(s)
- C. Available adsorption sites
- D. Septic tank effluent
- E. Distribution network
- F. None of the Above

133. Which of the following terms can be used for a broad range of applications, including single-family residences, large commercial establishments, and small communities?

- A. Decanter
- B. Sand filter(s)
- C. Chemical adsorption
- D. Fixed-film bioreactor(s)
- E. Diffused air or mechanical devices
- F. None of the Above

134. Sand filters are frequently used to pretreat septic tank effluent prior to \_\_\_\_\_ the soil has insufficient unsaturated depth.

- A. Surface water
- B. Recirculating filter(s)
- C. Available adsorption sites
- D. Septic tank effluent
- E. Subsurface infiltration onsite
- F. None of the Above

135. Which of the following terms are used primarily to treat domestic wastewater, but they have been used successfully in treatment trains to treat wastewaters high in organic materials?

- A. Decanter
- B. Sand filter(s)
- C. Chemical adsorption
- D. Fixed-film bioreactor(s)
- E. Diffused air or mechanical devices
- F. None of the Above

### **Recirculating Sand Filters (RSF)**

136. Recirculating filters using which missing term provide advanced secondary treatment of settled wastewater or septic tank effluent?

- A. Sand, gravel, or other media
- B. Wastewater
- C. Denitrification
- D. Phosphorus-reduction system(s)
- E. Excessive sludge production
- F. None of the Above

137. Which of the following terms collects and recycles the filter effluent to the recirculation tank for further processing or discharge?

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. Oxygen
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

138. The basic components of recirculating filters include a recirculation/dosing tank, pump and controls, distribution network, filter bed with an underdrain system, and a return line.

- A. True
- B. False

139. The returned aerobic filtrate in the recirculation tank, mixes with the anaerobic septic tank effluent before being reapplied to the?

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. Filter
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

140. Which of the following terms can be used for a broad range of applications, including single-family residences, large commercial establishments, and small communities?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. RSFs
- F. None of the Above

141. Denitrification also has not been shown to occur in RSFs.

- A. True
- B. False

### Natural Systems

142. According to the text, wetland systems are described in terms of the position of the water surface and/or the type of vegetation grown.

- A. True
- B. False

143. FWS wetlands with long detention times can remove minor amounts of \_\_\_\_\_ through plant uptake, adsorption, complexation, and precipitation.

- A. Total Solids
- B. TDS
- C. pH
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. Phosphorus
- F. None of the Above

144. Which of the following terms is typically greater in the first year or two because of soil absorption?

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. An aerobic wastewater treatment facility
- E. Oxygen demand of wastewater
- F. None of the Above

145. Which of the following terms is also possible with the use of an addition process, such as chemical addition and mixing prior to a final deep settling pond?

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. An aerobic wastewater treatment facility
- E. Oxygen demand of wastewater
- F. None of the Above

146. Subsurface flow wetlands are specifically designed to treat or polish \_\_\_\_\_ and are typically constructed as a bed or channel containing appropriate media.

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. Wastewater
- E. Oxygen demand of wastewater
- F. None of the Above

147. As with tank designs, in the natural system, bacteria break down organic matter in the wastewater, aerobically, anoxically and anaerobically.

- A. True
- B. False

148. Which of the following terms treat wastewater by bacterial decomposition, settling, and filtering?

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. Wetlands
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

149. Oxygen for which missing term is supplied by the plants growing in the wetland?
- A. Ammonia oxidation    D. An aerobic wastewater treatment facility  
 B. Phosphorus removal    E. Aerobic decomposition  
 C. Nitrate removal    F. None of the Above
150. Duckweed are floating macrophytes.
- A. True    B. False
151. Duckweed fronds can double their mass in two days under ideal conditions of nutrient availability, sunlight, and temperature.
- A. True    B. False
152. The wetland, effluent after two weeks is usually discharged by gravity to an unlined wetland bed, if these systems discharge effluent to oxidation ditches, they do not require a NPDES permit.
- A. True    B. False
153. Solids are filtered and finally settle out of the wastewater within the?
- A. Underdrain system    D. Conventional recirculation tank  
 B. Free water surface (FWS) systems    E. Anaerobic septic tank effluent  
 C. Wetland    F. None of the Above
154. The emergent macrophytes can transmit the amount of oxygen from the leaves to their roots is negligible compared to the oxygen demand of wastewater, therefore \_\_\_\_\_ are devoid of oxygen.
- A. Ammonia oxidation    D. An aerobic wastewater treatment facility  
 B. Phosphorus removal    E. Subsurface flow wetlands  
 C. Nitrate removal    F. None of the Above
155. Which of the following terms are a modification of subsurface flow wetlands which contain gravel or coarse sand and are loaded intermittently at the top surface?
- A. Trickling filter(s)    D. Vertical flow wetland beds  
 B. Oxidation Ditches    E. Recirculating sand filters (RSFs)  
 C. Nitrogen removal system(s)    F. None of the Above
156. Which of the following terms in a subsurface flow wetland can be rapid and effective because the anoxic conditions and carbon sources?
- A. Wastewater temperature    D. An aerobic wastewater treatment facility  
 B. Phosphorus removal    E. Oxygen demand of wastewater  
 C. Nitrate removal    F. None of the Above
157. Which of the following terms have been used for a number of years to treat wastewater for various purposes?
- A. Duckweed    D. Conventional recirculation tank  
 B. Free water surface (FWS) systems    E. Anaerobic septic tank effluent  
 C. Oxygen    F. None of the Above

158. Duckweed can grow about six months per year in most U.S. climates. High levels of BOD and \_\_\_\_\_ removal have been observed from duckweed systems..

- A. Total Solids
- B. TDS
- C. pH
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. TSS
- F. None of the Above

159. Nitrogen is removed by plant uptake and?

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Harvesting, by denitrification
- E. Biosurfactant trehalose
- F. None of the Above

160. A disadvantage of duckweed systems is the large amount of biomass produced by the rapidly growing plants, which creates a \_\_\_\_\_ requirement.

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. Solids handling
- E. Oxygen demand of wastewater
- F. None of the Above

### **Proprietary Filters/Improved and Emerging Technologies Sustainable Nutrient Recovery**

161. Studies have shown that about 80 percent of the \_\_\_\_\_ and 50 percent of the phosphorus in wastewater are derived from urine?

- A. Total Solids
- B. TDS
- C. pH
- D. Nitrogen
- E. Wastewater temperature
- F. None of the Above

162. Which of the following wastewater terms and pollution, nutrients could be recycled for agricultural use, and could be removed before being mixed with wastewater and released to the environment?

- A. Total Solids
- B. TDS
- C. pH
- D. Nitrogen
- E. Nitrogen and phosphorus
- F. None of the Above

163. If you could separate 50 to 60 percent of urine, this could reduce in-plant carbon dioxide gas discharges and result in fewer impurities in methane captured from sludge digestion.

- A. True
- B. False

164. According to the text, one benefit would be reduced energy consumption at WWTPs as a result of reduced treatment requirements for?

- A. Total Solids
- B. TDS
- C. pH
- D. Nitrogen
- E. Nitrogen and phosphorus
- F. None of the Above

### **Nutrient Removal for Small Communities and Decentralized Wastewater Treatment Systems**

165. Which of the following wastewater terms treat and dispose of effluent on the same property that produces the wastewater?

- A. Groundwater recharge
- B. Community drainfield(s)
- C. High-aluminum mud(s)
- D. Onsite septic systems
- E. Small volumes of wastewater
- F. None of the Above

166. According to the text, wastewater from several homes is pretreated onsite by individual septic tanks before being transported through alternative sewers to \_\_\_\_\_ treatment unit that is relatively simple to operate and maintain.

- A. An offsite decentralized
- B. Wastewater
- C. Denitrification
- D. Phosphorus-reduction system(s)
- E. Excessive sludge production
- F. None of the Above

167. Wastewater systems such as community drainfields, irrigation systems, and \_\_\_\_\_ are being installed to reduce infrastructure investment and minimize adverse environmental impacts.

- A. Wildlife habitat
- B. Package plants
- C. Denitrification
- D. Phosphorus-reduction system(s)
- E. Excessive sludge production
- F. None of the Above

168. Additional alternatives that include \_\_\_\_\_, sand filters, and constructed wetlands can be used to reduce nutrient pollution.

- A. Groundwater recharge
- B. Community drainfield(s)
- C. High-aluminum mud(s)
- D. Aerobic tanks
- E. Small volumes of wastewater
- F. None of the Above

### Phosphorus Removal

169. Few phosphorus removal processes are well developed for which missing term application?

- A. Onsite wastewater systems
- B. Wastewater
- C. Denitrification
- D. Phosphorus-reduction system(s)
- E. Excessive sludge production
- F. None of the Above

170. The controlled addition of chemicals such as aluminum, iron, and calcium compounds with subsequent flocculation and sedimentation has had only limited success because of inadequate operation and maintenance of mechanical equipment and excessive sludge production.

- A. True
- B. False

171. Studies of high-iron sands and which missing term indicate that 50 to 95 percent of the phosphorus can be removed?

- A. Groundwater recharge
- B. Community drainfield(s)
- C. High-aluminum mud(s)
- D. Nitrogen and phosphorus pollution
- E. Small volumes of wastewater
- F. None of the Above

### Nitrogen Removal

172. Processes that remove 75 to 100 percent of total nitrogen include aerobic biological systems and media filters, especially recirculating filters.

- A. True
- B. False

173. The vast majority of on-site and cluster nitrogen-removal systems employ nitrification and?

- A. Groundwater recharge
- B. Community drainfield(s)
- C. High-aluminum mud(s)
- D. Denitrification biological reactions
- E. Small volumes of wastewater
- F. None of the Above

174. SBRs, and an array of \_\_\_\_\_ combined with an anoxic/anaerobic process to perform denitrification.

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

175. There are systems that utilize membrane solids separation following \_\_\_\_\_ are capable of removing total nitrogen down to very low concentrations.

- A. Nitrogen removal system(s)
- B. Tertiary process
- C. Biological nitrification and denitrification
- D. Suspended film system(s)
- E. Recirculating sand filters (RSFs)
- F. None of the Above

176. Which of the following terms are located last in the treatment train prior to subsurface wastewater infiltration system disposal or surface water disposal?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

### **Secondary Clarification Process**

177. The SCP provides quiescent (or calm) conditions that allow the larger aggregates of solids and microorganisms to settle out for collection.

- A. True
- B. False

178. In the SCP, the majority of microorganism-rich underflow is re-circulated to Tanks as Return Sludge to help sustain the microorganism population in the?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

### **Fixed Film Systems**

179. Which of the following wastewater terms grow microorganisms on substrates such as rocks, sand or plastic?

- A. Mature biofilm
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology
- E. Fixed film systems
- F. None of the Above

180. The wastewater is spread over the substrate, allowing the wastewater to flow past the film of microorganisms fixed to the substrate.

- A. True
- B. False

181. Which of the following wastewater terms and rotating biological contactors, and sand filters are examples of fixed film systems?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above



### **Suspended Film Systems**

182. As the microorganisms absorb organic matter and nutrients from the wastewater, they grow in size and number. After the microorganisms have been suspended in the wastewater for several hours, they are settled out as sludge.

A. True B. False

183. Which of the following wastewater terms stir and suspend microorganisms in wastewater?

- A. Nitrogen removal system(s)
- B. Tertiary process
- C. Microorganism(s)
- D. Suspended film system(s)
- E. Recirculating sand filters (RSFs)
- F. None of the Above

184. Activated sludge, \_\_\_\_\_, oxidation ditch, and sequential batch reactor systems are all examples of suspended film systems.

- A. Trickling filter(s)
- B. Extended aeration
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

### **Lagoon Systems**

185. Lagoon systems are shallow basins that hold the waste-water for several months to allow for the natural degradation of sewage.

A. True B. False

186. Lagoon systems take advantage of \_\_\_\_\_ and microorganisms in the wastewater to renovate sewage.

- A. Nitrogen removal system(s)
- B. Tertiary process
- C. Natural aeration
- D. Suspended film system(s)
- E. Recirculating sand filters (RSFs)
- F. None of the Above

### **Other Important Wastewater Characteristics**

187. One important wastewater characteristic that can affect public health and the environment, as well as the design, cost, and?

- A. Treatment processes
- B. Total dissolved solids (TDS)
- C. Quality of the water
- D. The environment
- E. Effectiveness of treatment
- F. None of the Above

### **Temperature**

188. The best temperatures for wastewater treatment probably range from 77 to 95 degrees Fahrenheit.

A. True B. False

189. Biological treatment activity accelerates in warm temperatures and slows in cool temperatures, but \_\_\_\_\_ can stop treatment processes altogether.

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Total Suspended Solids (TSS)
- E. Extreme hot or cold
- F. None of the Above

190. Hot water is a byproduct of many manufacturing processes and is not considered a pollutant. When discharged in large quantities, it can raise the temperature of receiving streams improving the natural balance of aquatic life.  
A. True B. False

### pH

191. The acidity or alkalinity of wastewater affects both treatment and the environment.  
A. True B. False

192. Low pH indicates increasing acidity while a high pH indicates increasing alkalinity.  
A. True B. False

193. Which of the following terms of wastewater needs to remain between 6 and 9 to protect organism?  
A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Wastewater temperature  
C. pH F. None of the Above

194. Other substances and some acids can alter \_\_\_\_\_ can inactivate treatment processes when they enter wastewater from industrial or commercial sources.  
A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Wastewater temperature  
C. pH F. None of the Above

### Total Dissolved Solids

195. Pure water is tasteless, colorless, and odorless and is often called the “universal solvent”.  
A. True B. False

196. Which of the following wastewater terms is a good solvent and picks up impurities easily?  
A. Treatment processes D. Wastewater  
B. Total dissolved solids (TDS) E. Water  
C. Quality of the water F. None of the Above

197. Which of the following wastewater terms refer to any minerals, salts, metals, cations or anions dissolved in water?  
A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Dissolved solids  
C. pH F. None of the Above

198. Which of the following wastewater terms comprise inorganic salts and some small amounts of organic matter that are dissolved in water?  
A. Treatment processes D. Both treatment and the environment  
B. Total dissolved solids (TDS) E. Universal solvent  
C. Quality of the water F. None of the Above

199. TDS in drinking-water originate from natural sources, sewage, urban run-off, industrial wastewater, and chemicals used in the water treatment process.  
A. True B. False

200. The total dissolved solids test provides a qualitative measure of the amount of dissolved ions, but does not tell us the nature or ion relationships.

A. True B. False

201. Which of the following wastewater terms has been due to natural environmental features such as: mineral springs, carbonate deposits, salt deposits, and seawater intrusion?

A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Wastewater temperature  
C. pH F. None of the Above

202. Which of the following wastewater terms is the concentration of the sum of the cations (positively charged) and anions ions in the water?

A. Treatment processes D. Both treatment and the environment  
B. Total dissolved solids (TDS) E. Universal solvent  
C. Quality of the water F. None of the Above

203. The TDS test does not provide us insight into the specific water quality issues, such as: Elevated Hardness, Salty Taste, or?

A. Total Solids D. Corrosiveness  
B. TDS E. Wastewater temperature  
C. pH F. None of the Above

#### **Total Solids**

204. Which of the following wastewater terms refers to matter suspended or dissolved in water or wastewater, and is related to both specific conductance and turbidity?

A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Wastewater temperature  
C. pH F. None of the Above

205. Which of the following wastewater terms is used for material left inside a container after evaporation and drying of a water sample?

A. Treatment processes D. Total solids  
B. Total dissolved solids (TDS) E. pH  
C. Quality of the water F. None of the Above

206. Which of the following wastewater terms includes both total suspended solids, the portion of total solids retained by a filter and total dissolved solids?

A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Wastewater  
C. pH F. None of the Above

207. Which of the following wastewater terms can be measured by evaporating a water sample in a weighed dish, and then drying the residue in an oven at 103 to 105° C?

A. Treatment processes D. Total Suspended solids  
B. Total dissolved solids (TDS) E. Wastewater  
C. Quality of the water F. None of the Above

208. The increase in weight of the dish represents the total solids. Instead of total solids, laboratories often measure total suspended solids and/or total dissolved solids.

A. True B. False

**Total Suspended Solids (TSS)**

209. Total Suspended Solids (TSS) are solids in water that can be trapped by a filter.

A. True B. False

210. Which of the following wastewater terms can also cause an increase in surface water temperature, because the suspended particles absorb heat from sunlight?

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Total Suspended Solids (TSS)
- E. Suspended sediment
- F. None of the Above

211. When suspended solids settle to the bottom of a water body, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae.

A. True B. False

212. Which of the following wastewater terms can fill in spaces between rocks that could have been used by aquatic organisms for homes?

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Total Suspended Solids (TSS)
- E. Suspended sediment
- F. None of the Above

213. Which of the following wastewater terms can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage?

- A. Total Solids
- B. TDS
- C. pH
- D. TSS
- E. Wastewater
- F. None of the Above

214. Which of the following wastewater terms can block light from reaching submerged vegetation?

- A. Total Solids
- B. TDS
- C. pH
- D. Total Suspended Solids (TSS)
- E. High TSS
- F. None of the Above

215. Wastewater treatment plants are designed to function as "microbiology farms," where bacteria and other microorganisms are fed oxygen and organic waste.

A. True B. False

216. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die.

A. True B. False

217. Estimating \_\_\_\_\_ for centralized treatment systems is a complicated task, especially when designing a new treatment plant in a community where one has never existed previously.

- A. Peak flow(s)
- B. Flow volume(s)
- C. Additional flows
- D. This can increase flow(s)
- E. Original design load
- F. None of the Above

218. Engineers must allow for \_\_\_\_\_ during wet weather due to inflow and infiltration of extra water into sewers.

- A. Peak flow(s)
- B. Flow volume(s)
- C. Additional flows
- D. This can increase flow(s)
- E. Original design load
- F. None of the Above

219. Which of the following terms can enter sewers through leaky manhole covers and cracked pipes and pipe joints, diluting wastewater?

- A. Peak flow(s)
- B. Flow volume(s)
- C. Additional flows
- D. Excess water
- E. Original design load
- F. None of the Above

220. The focus of wastewater treatment plants is to reduce which missing term in the effluent discharged to natural waters, meeting state and federal discharge criteria?

- A. BOD and COD
- B. Some contaminants
- C. Secondary treatment effluent
- D. Soluble nutrients
- E. Oxygen and organic waste
- F. None of the Above

221. Treatment of wastewater usually involves which term such as the activated sludge system in the secondary stage after preliminary screening?

- A. Biological processes
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology
- E. Pretreatment and pollution prevention
- F. None of the Above

222. These secondary treatment steps that harness natural self-purification processes contained in bioreactors for the biodegradation of organic matter and bioconversion of \_\_\_\_\_ in the wastewater.

- A. Biofilm
- B. Some contaminants
- C. Secondary treatment effluent
- D. Soluble nutrients
- E. Oxygen and organic waste
- F. None of the Above

### **Application Specific Microbiology**

223. Which of the following terms is the preferred methodology in wastewater treatment affecting the efficiency of biological nutrient removal?

- A. Mature biofilm
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology
- E. Pretreatment and pollution prevention
- F. None of the Above

224. Laboratory prepared bugs are more efficient in organics removal if they have the right growth environment; this efficiency is multiplied if microorganisms are allowed to grow.

- A. True
- B. False

225. To reduce the start-up phase for growing a mature biofilm one can also purchase \_\_\_\_\_ from appropriate microbiology vendors.

- A. Mature biofilm
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology culture
- E. Pretreatment and pollution prevention
- F. None of the Above

### Advanced Methods of Wastewater Treatment

226. As our country and the demand for clean water have grown, it has become more important to produce cleaner wastewater effluents, yet \_\_\_\_\_ are more difficult to remove than others.

- A. Biofilm
- B. Some contaminants
- C. Secondary treatment effluent
- D. Soluble nutrients
- E. Oxygen and organic waste
- F. None of the Above

227. Pretreatment and pollution prevention which helps limit \_\_\_\_\_ discharged to the sanitary sewer system.

- A. Types of wastes
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology
- E. Pretreatment and pollution prevention
- F. None of the Above

228. All WWTPs provide a minimum of?

- A. Biofilm
- B. Secondary treatment
- C. Secondary treatment effluent
- D. Pretreatment and pollution prevention
- E. Oxygen and organic waste
- F. None of the Above

### Advanced Treatment Technologies

229. Treatment levels beyond secondary are called advanced treatment.

- A. True
- B. False

230. Which of the following terms can be extensions of conventional secondary biological treatment to further stabilize oxygen-demanding substances?

- A. Mature biofilm
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology
- E. Pretreatment and pollution prevention
- F. None of the Above

231. Advanced treatment may include physical-chemical separation techniques such as adsorption, flocculation/precipitation, membranes for advanced filtration, \_\_\_\_\_, and reverse osmosis.

- A. Denitrification process
- B. Organic material
- C. Ion exchange
- D. Aeration in the reactor
- E. Application-specific microbiology
- F. None of the Above

### Nitrogen Control

232. Nitrogen in one form or another is present in municipal wastewater and is usually not removed by secondary treatment.

- A. True
- B. False

233. Ammonia in wastewater effluent is safe to aquatic life.

- A. True
- B. False

234. Nitrogen in the form of \_\_\_\_\_ can exert a direct demand on oxygen or stimulate the excessive growth of algae.

- A. Nitrification
- B. Ammonia
- C. Nitrogen
- D. Nitrogen in the nitrate form
- E. Ammonia to the non-toxic nitrate
- F. None of the Above

235. Which of the following wastewater treatment terms beyond the secondary stage, nitrifying bacteria present in wastewater treatment can biologically convert ammonia to the non-toxic nitrate through a process known as nitrification?

- A. Nitrification
- B. Denitrification
- C. Nitrogen
- D. Nitrogen in the nitrate form
- E. Biological treatment
- F. None of the Above

236. Which of the following wastewater treatment terms process can be added to the system to convert the nitrate to nitrogen gas?

- A. Nitrification
- B. Denitrification
- C. Nitrogen
- D. Nitrogen in the nitrate form
- E. Additional biological
- F. None of the Above

### **Conversion of Nitrate to Nitrogen Gas**

237. The conversion of nitrate to \_\_\_\_\_ is accomplished by bacteria in a process known as denitrification.

- A. Nitrogen gas
- B. Phosphorus
- C. Nitrogen
- D. Nitrate nitrogen
- E. Methanol
- F. None of the Above

238. Which of the following wastewater treatment terms are added or a small stream of raw wastewater is mixed in with the nitrified effluent?

- A. Nitrogen gas
- B. Phosphorus
- C. Nitrogen
- D. Nitrate nitrogen
- E. Methanol
- F. None of the Above

239. Which of the following wastewater treatment terms - comprises almost 80 percent of the air in the earth's atmosphere?

- A. Phosphorus
- B. Phosphorus
- C. Nitrogen
- D. Nitrate nitrogen
- E. Methanol
- F. None of the Above

### **Biological Phosphorus Control**

240. Like nitrogen, phosphorus is also a necessary nutrient for the growth of algae.

- A. True
- B. False

241. Which of the following wastewater treatment terms removal can be achieved through chemical addition and a coagulation-sedimentation process?

- A. Nitrification
- B. Phosphorus
- C. Nitrogen
- D. Nitrate nitrogen
- E. Oxygen
- F. None of the Above

242. Some biological treatment processes called biological nutrient removal (BNR) can also achieve nutrient reduction, removing?

- A. Both nitrogen and phosphorus
- B. Phosphorus
- C. Nitrogen
- D. Nitrate nitrogen
- E. Oxygen
- F. None of the Above

243. BNR processes involve modifications of suspended growth treatment systems in that the bacteria in these systems also convert this compound to inert nitrogen gas.

- A. Both nitrogen and phosphorus
- B. Phosphorus
- C. Nitrogen
- D. Nitrate nitrogen
- E. Oxygen
- F. None of the Above

### Coagulation-Sedimentation Process

244. Solids heavier than water settle out of wastewater by gravity. With the addition of specific chemicals, solids can become heavier than water and will settle.

- A. True
- B. False

245. Which of the following wastewater treatment terms is used to increase the removal of solids from effluent after primary and secondary treatment?

- A. Carbon adsorption
- B. An advanced process
- C. A form of stabilization
- D. Chemical coagulation-sedimentation
- E. Processed wastewater solids ("sewage sludge")
- F. None of the Above

246. Which of the following wastewater treatment terms -added to the wastewater to remove phosphorus?

- A. Other alkaline materials
- B. A form of stabilization
- C. Sewage solids, or sludge
- D. Alum, lime, or iron salts are chemicals
- E. Phosphate
- F. None of the Above

247. Which of the following wastewater treatment terms is considered an advanced process because it is not routinely applied to the treatment of municipal wastewater?

- A. Carbon adsorption
- B. An advanced process
- C. Coagulation-sedimentation
- D. A form of stabilization
- E. Processed wastewater solids ("sewage sludge")
- F. None of the Above

### Carbon Adsorption

248. Carbon adsorption technology can remove organic materials from wastewater that resist removal by?

- A. Denitrification process
- B. Biological treatment
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Anaerobic sludge
- F. None of the Above

249. Which of the following wastewater treatment terms - consists of passing the wastewater effluent through of activated carbon granules or powder?

- A. Carbon adsorption
- B. An advanced process
- C. Carbonic dioxide
- D. A form of stabilization
- E. Super treatment
- F. None of the Above

### The Use or Disposal of Wastewater Residuals and Biosolids

250. When pollutants are removed from water, there may be the \_\_\_\_\_ that settle to the bottom of sedimentation tanks.

- A. Other alkaline materials
- B. Solids
- C. Sewage solids, or sludge
- D. Biosolids
- E. Rags and sticks
- F. None of the Above



251. The utilization and disposal of the residual process solids is addressed by the CWA, Resource Conservation and Recovery Act (RCRA), and other federal laws.  
A. True B. False

### Processed Wastewater Solids

252. Which of the following wastewater treatment terms are considered biosolids and need to meet rigorous standards allowing safe reuse for beneficial purposes?  
A. Other alkaline materials D. Processed wastewater solids  
B. A form of stabilization E. Rags and sticks  
C. Sewage solids, or sludge F. None of the Above

### Biosolids Stabilization

253. Prior to utilization or disposal, \_\_\_\_\_ are stabilized to control odors and reduce the number of disease-causing organisms.  
A. Biosolids D. Other alkaline materials  
B. An advanced process E. Processed wastewater solids ("sewage sludge")  
C. Sewage solids, or sludge F. None of the Above

254. Which of the following wastewater treatment terms when separated from the wastewater, contain around 98 percent water?  
A. Biosolids D. Other alkaline materials  
B. An advanced process E. Processed wastewater solids ("sewage sludge")  
C. Sewage solids, or sludge F. None of the Above

### Dewatering Processes

255. To improve dewatering effectiveness, the solids can be pretreated with chemicals such as lime, ferric chloride, or polymers to produce larger particles that are easier to remove.  
A. True B. False

256. Which of the following wastewater treatment terms include drying beds, belt filter presses, plate and frame presses, and centrifuges?  
A. Dewatering processes D. Stabilization of solids  
B. A form of stabilization E. Digestion  
C. Sewage solids, or sludge F. None of the Above

### Digestion

257. Digestion is a form of \_\_\_\_\_ where the volatile material can decompose naturally and the potential for odor production is reduced.  
A. Dewatering processes D. Stabilization of solids  
B. Release E. Stabilization  
C. Sewage solids, or sludge F. None of the Above

258. Which of the following wastewater treatment terms - in an enclosed tank has the added benefit of producing methane gas that can be recovered and used as a source of energy?  
A. Dewatering processes D. Stabilization of solids  
B. Digestion without air E. Digestion  
C. Sewage solids, or sludge F. None of the Above

259. Which of the following wastewater treatment terms may also be accomplished by composting, heat treatments, drying or the addition of lime or other alkaline materials?
- A. Dewatering processes
  - B. A form of stabilization
  - C. Sewage solids, or sludge
  - D. Stabilization of solids
  - E. Digestion
  - F. None of the Above

#### **Water Quality Criteria**

260. The Clean Water Act directs the EPA to develop criteria for water quality that accurately reflect the latest scientific knowledge about the effects of pollutants on aquatic life and human health.
- A. True
  - B. False

261. The Clean Water Act and the EPA includes specific information on the concentration and dispersal of pollutants through biological, physical, and chemical processes as well as the effects of pollutants on biological communities as a whole.
- A. True
  - B. False

#### **Human Health Criteria**

262. EPA scientists research information to determine the levels at which specific chemicals are not likely to adversely affect water quality standard(s).
- A. True
  - B. False

#### **Aquatic Life Criteria**

263. Allowable concentrations provide protection for plants and animals that are found in surface waters.
- A. True
  - B. False

264. Allowable concentrations are designed to provide protection for both freshwater and saltwater aquatic organisms from the effects of acute and chronic exposure to potentially harmful chemicals.
- A. True
  - B. False

265. Which of the following wastewater treatment terms are based on toxicity information and are developed to protect aquatic organisms from death, slower growth, reduced reproduction, and the accumulation of harmful levels of toxic chemicals in their tissues that may adversely affect consumers of such organisms?
- A. Aquatic life criteria
  - B. Water pollutant(s)
  - C. Water quality standard(s)
  - D. Concentration of pollutant(s)
  - E. A pollutant level
  - F. None of the Above

#### **Sediment Quality Criteria Guidance**

266. Which of the following wastewater treatment terms provide a habitat for many living organisms?
- A. Allowable concentrations
  - B. Water quality
  - C. Sediments
  - D. Acute (short term) and chronic (long term)
  - E. Human health and aquatic life criteria
  - F. None of the Above

### **Pollutants in the Sediment**

267. Which of the following wastewater treatment terms helps to protect bottom dwelling species and prevents harmful toxins from moving up the food chain?

- A. Pollutants in the sediment
- B. Water pollutant(s)
- C. Water quality standard(s)
- D. Concentration of pollutant(s)
- E. A pollutant level
- F. None of the Above

268. Which of the following wastewater treatment terms in the sediment that does not harm snails of small fish may bioaccumulate in the food chain?

- A. Aquatic life criteria
- B. Water pollutant(s)
- C. Water quality standard(s)
- D. Concentration of pollutant(s)
- E. A pollutant level
- F. None of the Above

269. Which of the following wastewater treatment terms - The EPA developed on the concentrations or amounts of individual chemicals which can be present in river, lake, or stream sediments

- A. Toxic quality criteria guidance
- B. Food chain quality guidance
- C. Biological integrity guidance
- D. Biological treatment(s) quality criteria guidance
- E. Sediment quality criteria guidance
- F. None of the Above

### **Biological Criteria**

270. A water body in its natural condition is free from \_\_\_\_\_, habitat loss, and other negative stressors.

- A. Allowable concentrations
- B. Harmful effects of pollution
- C. In a healthy aquatic community
- D. Acute (short term) and chronic (long term)
- E. Human health and aquatic life criteria
- F. None of the Above

271. The EPA is developing methodologies that states can use to assess the biological integrity of their waters and, in so doing, set protective?

- A. Toxic pollutant(s)
- B. Food chain
- C. Biological integrity
- D. Biological treatment(s)
- E. Water quality standards
- F. None of the Above

272. These methodologies will describe scientific methods for determining a particular aquatic community's health and for maintaining optimal conditions in?

- A. Allowable concentrations
- B. Water quality
- C. A healthy aquatic community
- D. Various bodies of water
- E. Human health and aquatic life criteria
- F. None of the Above

### **Summary**

273. Biological wastewater treatment goals are to remove the non-settling solids and the dissolved organic load from the effluents by using microbial populations.

- A. True
- B. False

274. Biological treatments are generally part of secondary treatment systems.

- A. True
- B. False

275. The microorganisms used are responsible for the degradation of which term and the stabilization of organic wastes?

- A. Allowable concentrations
- B. Water quality
- C. In a healthy aquatic community
- D. Organic matter
- E. Human health and aquatic life criteria
- F. None of the Above

276. Some of the microorganisms present in wastewater treatment systems use the \_\_\_\_\_ of the wastewater as an energy source to grow?

- A. Toxic pollutant(s)
- B. Food chain
- C. Biological integrity
- D. Biological treatment(s)
- E. Organic content
- F. None of the Above

### **Wastewater/Pretreatment Sampling General Information**

277. In accordance with the Clean Water Act and \_\_\_\_\_, the POTW conducts a variety of sampling activities which must be closely coordinated.

- A. General Pretreatment Program Regulations
- B. Each site user and
- C. All industrial users and
- D. Priority Pollutants within
- E. Characteristics of the wastes
- F. None of the Above

### **Permit Application Policy Example**

278. All industrial users that require a permit must be sampled to determine the characteristics of the \_\_\_\_\_ to be discharged into the POTW's sewer system.

- A. SROG
- B. Local limits
- C. Outer limits
- D. Priority Pollutants
- E. Wastes
- F. None of the Above

279. Prior to the issuance of a permit for existing industrial users, the POTW samples the user's effluent, and performs the analyses required by the applicable discharge standards (i.e., Categorical standards or?

- A. Taste test
- B. Local limits
- C. SDWA
- D. Priority Pollutants
- E. Characteristics of the wastes
- F. None of the Above

280. For new industrial users, estimates of the \_\_\_\_\_ to be discharged into the POTW's sewer system must be submitted along with the permit application.

- A. Wastes
- B. CWA
- C. Odor
- D. Priority Pollutants
- E. Characteristics of the wastes
- F. None of the Above

281. No sampling would be performed at these new facilities, since they do not presently discharge wastes into the?

- A. POTWs
- B. Sewer system
- C. CMOM
- D. Priority system
- E. Interceptor
- F. None of the Above

282. A four-day sampling program is usually conducted at \_\_\_\_\_ to collect both composite and grab (for pollutants not amenable to composite sampling) samples as needed.

- A. POTWs
- B. Each site
- C. All industrial users
- D. The interceptor
- E. The manhole
- F. None of the Above

**Wastewater and Pretreatment Compliance Monitoring**

283. There are two types of \_\_\_\_\_ that are performed as part of compliance monitoring for permitted industries: unscheduled and demand.

- A. Discharge concentrations
- B. Pollutants of concern
- C. Plant sampling activity
- D. Sampling activities
- E. Manual collection of grab samples
- F. None of the Above

284. Which of the following terms is used to determine the compliance status of the user?

- A. Flow-proportional sampling
- B. POTW samples
- C. Unscheduled sampling
- D. Composite and grab samples
- E. Unannounced monitoring visits
- F. None of the Above

285. Instances of noncompliance are often identified during unannounced monitoring visits. No notice is given for this type of sampling. This type of sampling is performed two to four times a year, at each industrial user site, over a two to five-day period to obtain sampling data

- A. True
- B. False

286. Which of the following terms is usually initiated in response to a known or suspected violation?

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Demand sampling
- F. None of the Above

287. The length of the sampling program depends on the flow, nature of the wastes, and type of samples, typically, \_\_\_\_\_ are collected at each user site.

- A. Flow-proportional sampling
- B. POTW samples
- C. BOD and SS levels
- D. Composite and grab samples
- E. Unannounced smell tests
- F. None of the Above

**Nonpermitted Industrial Users (User Rate Charge Program) Policy Example**

288. On a periodic basis, commercial and minor industrial users are sampled to determine?

- A. Discharge concentrations
- B. Pollutants of concern
- C. Plant sampling activity
- D. Discharge concentrations of various pollutants
- E. Manual collection of grab samples
- F. None of the Above

289. Typical types of users which may be sampled include: restaurants, photo processing laboratories, laundries, car washes, and printing shops. A three- to four-day sampling program is usually conducted at each assigned site.

- A. True
- B. False

### Wastewater Treatment Plant Sampling

290. POTW samples are collected in accordance with the National Pollutant Discharge Elimination System (NPDES) permit which sets discharge limits for certain pollutants and specifies sampling frequencies and?

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Sample types
- F. None of the Above

291. The POTW is responsible for coordinating the plant sampling activity with laboratory personnel who prepare any special sampling bottles and laboratory appurtenances necessary to complete the?

- A. Flow-proportional sampling
- B. POTW samples
- C. BOD and SS levels
- D. Composite and grab samples
- E. Sampling objectives
- F. None of the Above

292. Control Authorities should estimate flow to allow for collection of grab samples, which are required, unless flow-proportional sampling is not feasible.

- A. True
- B. False

293. Which of the following terms are preferred over time composite samples particularly where the monitored discharge is intermittent or variable?

- A. Flow-proportional sampling
- B. POTW samples
- C. BOD and SS levels
- D. Composite and grab samples
- E. Flow-proportional composite samples
- F. None of the Above

294. Desired analyses dictate the preparation protocols, equipment, and collection bottles to use to avoid contamination of samples or loss of pollutants through improper collection.

- A. True
- B. False

295. Sampling for such pollutants as \_\_\_\_\_, flashpoint, and volatile organic compounds require manual collection of grab samples.

- A. The sampling point(s)
- B. Sample preservation
- C. Duplicate samples
- D. Routine QA/QC measures
- E. pH, cyanide, oil and grease
- F. None of the Above

296. Which of the following terms is similar to composite samples, and must be representative of the monitored discharge and are to be collected from actively flowing wastestreams?

- A. Discharge concentrations
- B. Pollutants of concern
- C. Plant sampling activity
- D. Grab samples
- E. Manual collection of grab samples
- F. None of the Above

297. Fluctuations in flow or the nature of the discharge may require collection of and hand-compositing of \_\_\_\_\_ to accurately assess compliance.

- A. Flow-proportional sampling
- B. POTW samples
- C. BOD and SS levels
- D. Composite and grab samples
- E. More than one grab sample
- F. None of the Above

298. Control Authorities should develop and implement standard operating procedures and policies detailing \_\_\_\_\_ and handling protocols in accordance with 40 CFR Part 136.

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Sample collection
- E. Blanks
- F. None of the Above

299. Which of the following terms with the adherence to proper sample collection can be verified through review of field measurement records, chain of custodies, and lab reports?

- A. Discharge concentrations
- B. Pollutants of concern
- C. Plant sampling activity
- D. Handling protocols
- E. Manual collection of grab samples
- F. None of the Above

300. Field measurement records may require information regarding sample location, condition of and programmed settings for sampling equipment, wastewater meter readings, and information for such parameters as \_\_\_\_\_ which requires analysis in the field.

- A. The sampling point(s)
- B. Sample preservation
- C. pH and temperature
- D. Routine QA/QC measures
- E. Blanks
- F. None of the Above

301. Lab reports should contain the minimum information (e.g., analytical methodology, \_\_\_\_\_, time of analysis).

- A. Discharge concentrations
- B. Pollutants of concern
- C. Plant sampling activity
- D. Sample preparation date and time
- E. Manual collection of grab samples
- F. None of the Above

302. Which of the following terms will prompt recording of information necessary for demonstrating compliance with applicable requirements?

- A. Flow-proportional sampling
- B. POTW samples
- C. Standardized forms
- D. Composite and grab samples
- E. Unannounced monitoring visits
- F. None of the Above

### **Background on Emerging Contaminants**

303. Two groups of emerging pollutants that are not a threat to the systems are Endocrine disrupting chemicals and pharmaceutical and personal care products (PPCPs).

- A. True
- B. False

304. Which of the following terms may interfere with the endocrine systems by damaging hormone-producing tissues?

- A. PPCPs
- B. EDCs
- C. Ammonia oxidizing bacteria
- D. Longer activated sludge SRTs
- E. Slower growing bacteria
- F. None of the Above

305. Which of the following terms comprise a diverse collection of thousands of chemical substances, including prescriptions?

- A. SRTs
- B. PPCPs
- C. Nitrifying bacteria
- D. Any microbiological organisms
- E. Endocrine disrupting chemicals (EDCs)
- F. None of the Above

306. Which of the following terms refers broadly to those synthetic or naturally occurring chemicals, or to any microbiological organisms?

- A. SRTs
- B. PPCPs
- C. Nitrifying bacteria
- D. Emerging contaminants
- E. Endocrine disrupting chemicals (EDCs)
- F. None of the Above

307. Which of the following terms can fall into a wide range of groups defined by their effects, uses, or by their key chemical or microbiological characteristics?

- A. PPCPs
- B. Emerging contaminants
- C. Ammonia oxidizing bacteria
- D. Longer activated sludge SRTs
- E. Slower growing bacteria
- F. None of the Above

### **Removal of Emerging Contaminants by Nutrient Removal Technologies**

308. Removal efficiencies were enhanced for several investigated contaminants at longer SRTs, with critical \_\_\_\_\_ for some beyond which removal rates did not improve.

- A. SRTs
- B. PPCPs
- C. Nitrifying bacteria
- D. Any microbiological organisms
- E. Endocrine disrupting chemicals (EDCs)
- F. None of the Above

309. Which of the following terms allow for the establishment of slower growing bacteria, which in turn provide a more diverse community of microorganisms with broader physiological capabilities?

- A. PPCPs
- B. Longer SRTs
- C. Ammonia oxidizing bacteria
- D. Longer activated sludge SRTs
- E. Slower growing bacteria
- F. None of the Above

310. Which of the following terms may play a key role in biodegradation but the role of heterotrophic bacteria may also play a significant role?

- A. SRTs
- B. PPCPs
- C. Nitrifying bacteria
- D. Any microbiological organisms
- E. Endocrine disrupting chemicals (EDCs)
- F. None of the Above

311. Reverse osmosis has been found to effectively remove \_\_\_\_\_ below detection limits including those that were not consistently removed at longer SRTs.

- A. PPCPs
- B. Nitrification
- C. Ammonia oxidizing bacteria
- D. Longer activated sludge SRTs
- E. Slower growing bacteria
- F. None of the Above

### **Role of Solids Retention Time in Removal Efficiency**

312. Which of the following terms allow for the establishment of slower growing bacteria which in turn provide a more diverse community of microorganisms with broader physiological capabilities?

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Longer activated sludge SRTs
- D. An aerobic wastewater treatment facility
- E. Oxygen demand of wastewater
- F. None of the Above



313. Which of the following terms are routinely detected in influent were not well removed by secondary treatment?

- A. SRTs
- B. PPCPs
- C. Six compounds
- D. Any microbiological organisms
- E. Endocrine disrupting chemicals (EDCs)
- F. None of the Above

### **POTW's Wastewater Samples**

#### **General**

314. Hand compositing is a series of time proportional grab samples that are collected and composited by hand.

- A. True
- B. False

315. Generally, there are four types of samples that are collected by the POTW's Sampling Section: grab, time proportional composites, flow proportional composites, and hand composites.

- A. True
- B. False

316. Which of the following terms - used depends largely on the types of analyses to be run, and the nature of the wastestream being sampled?

- A. An analysis
- B. The sampling method
- C. Duplicate samples
- D. Taste test
- E. Blanks
- F. None of the Above

317. Which of the following sampling terms is an individual sample collected in less than 15 minutes without regard for flow or time of day.

- A. Entire batch discharge
- B. The volume of sample
- C. A grab sample
- D. An individual sample
- E. Proportional composite sampling
- F. None of the Above

318. pH, cyanide, oil and grease, sulfide, and volatile organics must be collected as composite samples.

- A. True
- B. False

319. Which of the following sampling terms - would then be taken by means of time proportional composite sampling methods or by hand composite will provide a representative sample of the effluent being discharged?

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Samples
- E. Blanks
- F. None of the Above

320. Which of the following sampling terms to be collected by any of these methods is dependent on the number and types of analyses that must be performed.

- A. Entire batch discharge
- B. The volume of sample
- C. Concentration of pollutants
- D. An individual sample
- E. Proportional composite sampling
- F. None of the Above

#### **Wastewater Grab Samples**

321. Grab samples are individual samples collected in less than 3 minutes without regard to flow or time of day.

- A. True
- B. False

322. Which of the following sampling terms are normally taken manually, but can be pumped?

- A. Quantify the pollutants
- B. Grab samples
- C. Hand composites
- D. Time proportional composite sampling methods
- E. Flow proportional composites
- F. None of the Above

**A grab sample is usually taken when a sample is needed to:**

323. Provide information about \_\_\_\_\_ of pollutants at a specific time.

- A. Entire batch discharge
- B. The volume of sample
- C. Concentration of pollutants
- D. An individual sample
- E. An instantaneous concentration
- F. None of the Above

324. According the text, quantify the \_\_\_\_\_ in a non-continuous discharge?

- A. Pollutants
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Blanks
- F. None of the Above

325. According the text, corroborate \_\_\_\_\_ if the waste is not highly variable.

- A. Entire batch discharge
- B. The volume of sample
- C. Composite samples
- D. An individual sample
- E. Proportional composite sampling
- F. None of the Above

326. Which of the following sampling terms are not amenable to compositing such as pH, temperature, dissolved oxygen, chlorine, purgeable organics and sulfides, oil and grease, coliform bacteria, and sulfites?

- A. Quantify the pollutants
- B. Grab samples
- C. Hand composites
- D. Monitor parameters
- E. Flow proportional composites
- F. None of the Above

### **Timed Composites**

327. Which of the following sampling terms are usually taken in instances where the intention is to characterize the wastes over a period of time without regard to flow?

- A. Timed samples
- B. Grab samples
- C. Hand composites
- D. Time proportional composite sampling methods
- E. Flow proportional composites
- F. None of the Above

328. Which of the following sampling terms consist of a series of equal volume grab samples taken at regular intervals?

- A. Timed composite samples
- B. Grab samples
- C. Hand composites
- D. Time proportional composite sampling methods
- E. Flow proportional composites
- F. None of the Above

### **Flow Proportional Composites**

329. Which of the following sampling terms consist of: a series of grab samples whose volumes are equal in size and proportion to the flow at the time of sampling?

- A. The sampling point(s)
- B. Sample preservation
- C. Duplicate samples
- D. Routine QA/QC measures
- E. Flow proportional composite samples
- F. None of the Above

330. Which of the following sampling terms are taken at varying time intervals, or continuous samples taken over a period of time based on the flow?

- A. Entire batch discharge
- B. The volume of sample
- C. Concentration of pollutants
- D. An individual sample
- E. Samples
- F. None of the Above

331. Wherever possible, grab sampling is recommended because it most accurately reflects the nature of the wastestream.

- A. True
- B. False

332. Which of the following sampling terms - taken at varying time intervals are most often collected by the sampling inspectors?

- A. Entire batch discharge
- B. The volume of sample
- C. Equal volume samples
- D. An individual sample
- E. Proportional composite sampling
- F. None of the Above

#### **Industrial Users - Permitted/Non-permitted Example**

333. Which of the following sampling terms - within an industry vary with each industry depending on the nature of the process and location of pretreatment facilities?

- A. The sampling point(s)
- B. Sample preservation
- C. Duplicate samples
- D. Routine QA/QC measures
- E. Blanks
- F. None of the Above

334. Exact sampling locations must be identified on a case by case basis. The following general principles apply in all cases: A permanent sampling location(s) must be identified for use by the collection system.

- A. True
- B. False

#### **Wastewater Sample Preservation**

335. One or more unstable pollutants that require immediate analysis or preservation until \_\_\_\_\_ can be made.

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Blanks
- F. None of the Above

336. According the text, sample preservation is needed for which missing term-, for example, which may be stored for as long as 24 hours prior to transferring them to the laboratory.

- A. Nitrified effluent
- B. Composite samples
- C. Total Nitrogen (TN)
- D. Nitrogen and phosphorus levels
- E. Activated sludge
- F. None of the Above

#### **Quality Assurance/Quality Control Policy Example**

337. According the text, Quality Assurance/Quality Control (QA/QC) measures taken by the sampling crew include equipment blanks, trip blanks, split samples and duplicate samples.

- A. True
- B. False

338. Equipment blanks and which missing term are routine QA/QC measures?

- A. The sampling point(s)
- B. Sample preservation
- C. Duplicate samples
- D. Routine QA/QC measures
- E. Trip blanks
- F. None of the Above

339. Which of the following sampling terms are taken for Local Limits (pretreatment) sampling and when requested by an industry or laboratory?

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Blanks
- F. None of the Above

340. Which of the following sampling terms should be run when requested by a Supervisor or Project Leader?

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Blanks
- F. None of the Above

341. The laboratory needs to prepare \_\_\_\_\_ used by the sampling crews.

- A. The sampling point(s)
- B. Sample preservation
- C. Duplicate samples
- D. Routine QA/QC measures
- E. All trip blanks/travel blanks
- F. None of the Above

342. Any contamination detected in the \_\_\_\_\_ would result from field exposure which could in turn affect collected samples.

- A. An analysis
- B. Split samples
- C. Duplicate samples
- D. Taste test
- E. Blanks
- F. None of the Above

### **Chain-of-Custody**

343. The collection, preservation and transportation of the chain of custody and all documentation is critical to the overall success of the Wastewater Sampling Program.

- A. True
- B. False

344. If sampling is performed for the Pretreatment program, any sampling data may be used as evidence in court proceedings in this case \_\_\_\_\_ becomes critical.

- A. Sampling crew
- B. Duplicate samples
- C. Pre-preserved bottles
- D. Documentation
- E. Noncompliant industrial user
- F. None of the Above

345. Laboratory personnel sign and date the chain of custody form, and return it to the sampling crew who makes two copies of the form. One copy is for the sampling crew files and the other is for data entry.

- A. True
- B. False

### **Proper Sample Handling**

346. The proper handling of \_\_\_\_\_ also includes wearing gloves.

- A. Other parameters
- B. Pre-preserved bottles
- C. Preservatives
- D. Some samples
- E. Water quality samples
- F. None of the Above

347. When the \_\_\_\_\_ are received from the laboratory, check to see that none have leaked.

- A. Other parameters
- B. Pre-preserved bottles
- C. Preservatives
- D. Some samples
- E. Containers and preservatives
- F. None of the Above

348. Which of the following wastewater sampling terms should be labeled with type of preservative used, type of analysis to be done and be accompanied by a Safety Data Sheet (SDS).

- A. Sampling crew
- B. Duplicate samples
- C. Pre-preserved bottles
- D. Sampling bottles
- E. Noncompliant industrial user
- F. None of the Above

349. Make sure you can tell if containers are pre-preserved, because you do not to overfill them when collecting samples in the field.

- A. True
- B. False

350. Check with the laboratory about \_\_\_\_\_ when using pre-preserved bottles.

- A. Other parameters
- B. Quality control procedures
- C. Preservatives
- D. Some samples
- E. Organics
- F. None of the Above

351. If necessary, obtain extra coolers and never store coolers and containers near solvents, fuels or other sources of contamination or combustion. In warm weather, keep coolers and samples in the shade.

- A. True
- B. False

### Field Parameters

352. Be sure to measure and record the field parameters of temperature, electrical conductivity, pH and \_\_\_\_\_ in an undisturbed section of stream flow.

- A. Nitrified effluent
- B. Nitrogen
- C. Total Nitrogen (TN)
- D. Dissolved oxygen
- E. Activated sludge
- F. None of the Above

### Dissolved Oxygen

353. Aerobic means without air and some bacteria thrive under these conditions and utilize the nutrients and chemicals available to exist.

- A. True
- B. False

354. At least two general forms of bacteria act in balance in a wastewater digester: Saprophytic organisms and?

- A. Methane Fermenters
- B. DO fermenters
- C. Carbon dioxide fermenters
- D. Butyric acid fermenters
- E. Aerobic fermenters
- F. None of the Above

355. The saprophytes exist on dead or decaying materials.

- A. True
- B. False

356. The methane fermenting bacteria require a pH range of 6.6 to 7.6 to be able to live and reproduce.

A. True B. False

357. Aerobic bacteria do not require oxygen to live and thrive.

A. True B. False

358. Aerobes decompose inorganics in the water; the result is carbon dioxide and H<sub>2</sub>SO<sub>4</sub>.

A. True B. False

359. Dissolved oxygen (DO) in water is considered a contaminant.

A. True B. False

360. Dissolved oxygen level is important because too much or not enough dissolved oxygen can create?

A. Unfavorable conditions                      D. Frequent dissolved oxygen measurement  
B. DO analysis                                      E. Aerobic conditions  
C. Carbon dioxide                                 F. None of the Above

361. A lack of Dissolved oxygen in natural waters creates?

A. Anaerobic conditions    D. Phosphorus-reduction system(s)  
B. Methane fermenters    E. Excessive sludge production  
C. Denitrification            F. None of the Above

362. Which of the following wastewater terms live on the volatile acids produced by these saprophytes?

A. Wildlife habitat                      D. Phosphorus-reduction system(s)  
B. Methane fermenters    E. Excessive sludge production  
C. Denitrification                      F. None of the Above

363. Which of the following wastewater terms indicate that dissolved oxygen is present.

A. Sample(s)                                 D. Frequent dissolved oxygen measurement  
B. DO analysis                                E. Aerobic conditions  
C. Carbon dioxide                          F. None of the Above

364. Which of the following wastewater terms in a water sample can be detrimental to metal pipes in high concentrations because oxygen helps accelerate corrosion?

A. Winkler Method                          D. Anaerobic conditions  
B. Dissolved Oxygen                        E. The iodometric (titration) test  
C. Only molecular oxygen                 F. None of the Above

365. Oxygen's primary value is to oxidize iron and manganese into forms that will precipitate out of the water; it also removes excess carbon dioxide.

A. True B. False

366. Which of the following wastewater terms in a water sample will affect the taste of drinking water?

A. Sample(s)                                 D. Dissolved oxygen  
B. DO analysis                                E. Aerobic conditions  
C. Carbon dioxide                          F. None of the Above

### Methods of Determination

367. Temperature, atmospheric pressure, salinity, biological activity and pH all have an effect on the (DO) content.

A. True B. False

368. Which of the following wastewater terms – procedure is based on the rate of diffusion of molecular oxygen across a membrane?

- A. Membrane electrode method
- B. Dissolved Oxygen
- C. Only molecular oxygen
- D. Anaerobic conditions
- E. Iodometric (titration) test
- F. None of the Above

369. Many factors determine the \_\_\_\_\_ in a water sample.

- A. Solubility of oxygen
- B. DO analysis
- C. Carbon dioxide
- D. Frequent dissolved oxygen measurement
- E. Aerobic conditions
- F. None of the Above

### Iodometric Test

370. The iodometric (titration) test is not a very precise and reliable for (DO) analysis of samples.

A. True B. False

371. Reactions take place with the addition of certain chemicals that liberate iodine equivalent to the?

- A. Original (DO) content
- B. Dissolved Oxygen
- C. Only molecular oxygen
- D. Anaerobic conditions
- E. Iodometric (titration) test
- F. None of the Above

372. Which of the following wastewater terms can liberate iodine from iodides, and some reducing agents reduce iodine to iodide?

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Certain oxidizing agents
- D. An aerobic wastewater treatment facility
- E. Oxygen demand of wastewater
- F. None of the Above

373. Which of the following wastewater terms effectively removes interference caused by nitrates in the water sample, so a more accurate determination of (DO) can be made?

- A. Winkler Method
- B. Dissolved Oxygen
- C. Only molecular oxygen
- D. The alkaline Iodide-Azide reagent
- E. The iodometric (titration) test
- F. None of the Above

374. Which of the following wastewater terms are highly dependent on the source and characteristics of the sample?

- A. Methods of analysis
- B. DO analysis
- C. Carbon dioxide
- D. Frequent dissolved oxygen measurement
- E. Aerobic conditions
- F. None of the Above

375. The magnetic method involves an oxygen permeable plastic membrane that serves as a diffusion barrier against impurities.

A. True B. False

376. The effect of oxidation wastes on streams, the suitability of water for fish and other organisms and the progress of self-purification can all be measured or estimated from the dissolved oxygen content.

A. True B. False

377. Which of the following wastewater terms passes through the membrane and is measured by the meter?

- A. Carbon dioxide
- B. Dissolved Oxygen
- C. Only molecular oxygen
- D. H<sub>2</sub>S
- E. Carbon
- F. None of the Above

378. According to the text, membrane electrodes provide an excellent method for \_\_\_\_\_ in polluted, highly colored turbid waters and strong waste effluents.

- A. Sample(s)
- B. DO analysis
- C. Carbon dioxide
- D. Frequent dissolved oxygen measurement
- E. Aerobic conditions
- F. None of the Above

379. Proper samples must be taken in \_\_\_\_\_ bottles where agitation or contact with air is at a minimum.

- A. Sample(s)
- B. DO analysis
- C. BOD
- D. Frequent dissolved oxygen measurement
- E. Aerobic conditions
- F. None of the Above

380. Which of the following wastewater terms is the one of the most important analyses in determining the quality of natural waters?

- A. Winkler Method
- B. Dissolved Oxygen
- C. The dissolved oxygen test
- D. Anaerobic conditions
- E. The iodometric (titration) test
- F. None of the Above

381. Which of the following wastewater terms measurement is essential for adequate process control?

- A. Sample(s)
- B. DO analysis
- C. Carbon dioxide
- D. Dissolved oxygen
- E. Aerobic conditions
- F. None of the Above

### **Sludge Volume Index (SVI)**

382. The higher the (SVI), the better is the settling quality of the aerated mixed liquor, low (SVI) of 50 or less is considered a good settling sludge.

A. True B. False

383. The Sludge Volume Index (SVI) of activated sludge is defined as the volume in milliliters occupied by which missing term- after settling for 30 minutes?

- A. A closed loop
- B. 1g of activated sludge
- C. Optimal DO levels
- D. Trickling filter FFSs
- E. A portion of the denitrified effluent
- F. None of the Above



### **Nitrogen and Phosphorus Removal Technologies**

384. Small system owners and operators should work closely with their program staff as well as engineers to ensure that the technologies selected will work effectively in combination to achieve the goals related to?

- A. Effluent
- B. Oxidation
- C. Optimal DO levels
- D. Trickling filter FFSs
- E. A portion of the denitrified effluent
- F. None of the Above

### **Genera**

385. In a single aerobic system, members of the genera Pseudomonas, Nocardia, Flavobacterium, Achromobacter and Zooglea may be present, together with filamentous organisms.

- A. True
- B. False

386. In a well-functioning system, protozoas and rotifers are usually present and are useful in consuming dispersed \_\_\_\_\_ or non-settling particles.

- A. Bacteria
- B. Attached growth processes
- C. Protozoas and rotifers
- D. Suspended growth processes
- E. Food-to-microorganism ratio, F/M
- F. None of the Above

387. The organic load present is incorporated in part as represented by \_\_\_\_\_ by the microbial populations, and almost all the rest is liberated as gas.

- A. Biological denitrification
- B. Organic load
- C. Bacteria
- D. Biomass
- E. Aerobic and facultative micro-organisms
- F. None of the Above

388. Unless the cell mass formed during the biological treatment is removed from the wastewater the treatment is largely incomplete, because the biomass itself will appear as organic load in the effluent and the only pollution reduction accomplished is that fraction liberated as gases.

- A. True
- B. False

389. The biological treatment processes used for wastewater treatment are broadly classified as aerobic in which aerobic and facultative microorganisms predominate or anaerobic which use?

- A. Biological denitrification
- B. Organic load
- C. Anaerobic microorganism
- D. Nitrogen and phosphorus
- E. Aerobic and facultative microorganisms
- F. None of the Above

390. Which of the following terms means the microorganisms that are attached to a surface over which they grow?

- A. Carbonaceous BOD
- B. Attached growth processes
- C. Protozoas and rotifers
- D. Suspended growth processes
- E. Food-to-microorganism ratio, F/M
- F. None of the Above

### **Aerobic Processes**

391. The most common aerobic processes are: activated sludge systems, lagoons, trickling filters and rotating disk contactors.

- A. True
- B. False

392. Which of the following terms are used to degrade carbonaceous BOD?

- A. Carbonaceous BOD
- B. Attached growth processes
- C. Activated sludge processes
- D. Suspended growth processes
- E. Food-to-microorganism ratio, F/M
- F. None of the Above

393. Which of the following terms are usually designed from pilot plant and laboratory studies?

- A. Biological denitrification
- B. Organic load
- C. Bacteria
- D. Nitrogen and phosphorus
- E. Activated sludge plants
- F. None of the Above

394. Which of the following terms is the amount of food provided to the bacteria in the aeration tank?

- A. Carbonaceous BOD
- B. Attached growth processes
- C. Mean cell residence time (MCRT)
- D. Suspended growth processes
- E. Food-to-microorganism ratio, F/M
- F. None of the Above

### Microorganisms in Lagoons

395. Swimming and \_\_\_\_\_ engulf bacteria or other prey.

- A. Strict aerobes
- B. Predators
- C. Bacteria
- D. Heterotrophic bacteria
- E. Gliding ciliates
- F. None of the Above

396. Which of the following bugs or terms attach to the biomass and vortex suspended bacteria into their gullets, while crawlers break bacteria loose from the floc surface?

- A. Treatment organism(s)
- B. Aerobic bacteria
- C. Stalked ciliate(s)
- D. Floc-forming bacteria
- E. Filamentous bacteria
- F. None of the Above

397. Microorganisms are directly affected by their treatment environment.

- A. True
- B. False

398. The following changes in food, dissolved oxygen, temperature, pH, total dissolved solids, sludge age, presence of toxins, and other factors create a dynamic environment for the?

- A. Treatment organism(s)
- B. Aerobic bacteria
- C. Stalked ciliate(s)
- D. Floc-forming bacteria
- E. Filamentous bacteria
- F. None of the Above

399. Food (organic loading) regulates?

- A. Strict aerobes
- B. Predators
- C. Microorganism numbers
- D. Heterotrophic bacteria
- E. Many bacterial species
- F. None of the Above

### Aerobic Bacteria

400. Three bacteria groups occur: freely dispersed, single bacteria; floc-forming bacteria; and filamentous bacteria. All function similarly to oxidize organic carbon to produce CO<sub>2</sub> and new bacteria.

- A. True
- B. False

401. Which of the following bugs or terms that occur are similar to those found in other treatment processes such as activated sludge?

- A. Treatment organism(s)
- B. Aerobic bacteria
- C. Stalked ciliate(s)
- D. Floc-forming bacteria
- E. Filamentous bacteria
- F. None of the Above

402. Which of the following bugs or terms that degrade wastes grow as single bacteria dispersed in the wastewater?

- A. Strict aerobes
- B. Predators
- C. Bacteria
- D. Heterotrophic bacteria
- E. Many bacterial species
- F. None of the Above

403. Which of the following bugs or terms, grow in a large aggregate due to exocellular polymer production?

- A. Treatment organism(s)
- B. Aerobic bacteria
- C. Stalked ciliate(s)
- D. Floc-forming bacteria
- E. Filamentous bacteria
- F. None of the Above

404. Growth form is important as these flocs degrade \_\_\_\_\_ and settle at the end of the process, producing a low TSS effluent.

- A. Anaerobic action
- B. Absence of free oxygen
- C. BOD
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

405. Which of the following terms occur in lagoons, usually at specific growth environments?

- A. Anaerobic action
- B. Absence of free oxygen
- C. A number of filamentous bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

406. Which of the following bugs or terms have a wide range in environmental tolerance and can function effectively in BOD removal over a wide range in pH and temperature?

- A. Strict aerobes
- B. Predators
- C. Bacteria
- D. Most heterotrophic bacteria
- E. Many bacterial species
- F. None of the Above

407. Anaerobic BOD removal generally proceeds well from pH 6.5 to 9.0 and at temperatures from 3-4°C to 60-70°C (Aerobic bacteria are replaced by Mesophilic bacteria at temperatures above 35°C).

- A. True
- B. False

408. BOD removal increases rapidly below 3-4°C and ceases at 1-2°C.

- A. True
- B. False

409. A very specialized group of bacteria occurs to some extent in lagoons (and other wastewater treatment systems) that can oxidize ammonia via nitrite to nitrate, termed?

- A. Strict aerobes
- B. Predators
- C. Nitrifying bacteria
- D. Heterotrophic bacteria
- E. Many bacterial species
- F. None of the Above

### **Aerated lagoons**

410. The aerated lagoons are basins, normally excavated in earth and operated without Solids recycling into the system. This is the major difference with respect to activated sludge systems.

A. True B. False

411. Two types are the most common: The Aerobic-anaerobic or partially suspended lagoon in which the concentration of solids and dissolved oxygen are maintained uniform and neither the incoming solids nor the biomass of microorganisms' settle, and the completely mixed lagoon.

A. True B. False

412. In the facultative lagoons, the power input is reduced causing accumulation of solids in the bottom which undergo \_\_\_\_\_, while the upper portions are maintained aerobic.

- A. Facultative lagoon(s)
- B. Anaerobic decomposition
- C. Aerated lagoon(s)
- D. Odors
- E. Complete nitrification
- F. None of the Above

413. Lagoons are exposed to low temperatures this can cause \_\_\_\_\_ and eventually the formation of ice.

- A. Non-biodegradable fraction
- B. Substantial alkalinity
- C. Completely mixed lagoon
- D. Reduced biological activity
- E. Suspended solids in the effluent
- F. None of the Above

414. If excavated basins are used for settling, care should be taken to provide a residence time long enough for the?

- A. Facultative lagoon(s)
- B. Sludge
- C. Solids to settle
- D. Odors
- E. Complete nitrification
- F. None of the Above

415. Which of the following terms might develop in the upper layers contributing to an increased content of suspended solids in the effluent?

- A. Non-biodegradable fraction
- B. Substantial alkalinity
- C. Completely mixed lagoon
- D. Settled sludge, and algae
- E. Suspended solids in the effluent
- F. None of the Above

416. Which of the following terms can be minimized by using minimum depths of up to 2 m?

- A. Facultative lagoon(s)
- B. Sludge
- C. Aerated lagoon(s)
- D. Odors
- E. Complete nitrification
- F. None of the Above

417. According to the text, accumulated solids will, overall?

- A. Non-biodegradable fraction
- B. Substantial alkalinity
- C. Completely mixed lagoon
- D. Decompose in the bottom
- E. Suspended solids in the effluent
- F. None of the Above

### **Nitrification**

418. Nitrosomonas europaea, which oxidizes ammonia to nitrite, and Nitrobacter winogradskyi, which oxidizes nitrite to nitrate.

A. True B. False

419. Which of the following bugs require a neutral pH and substantial alkalinity?

- A. Nitrifying bacteria D. Aerobic bacteria  
B. Methane forming bacteria E. Anaerobic, heterotrophic bacteria  
C. Two bacteria F. None of the Above

420. Nitrification ceases at pH values above pH 9 and declines markedly at pH values below 7.

A. True B. False

421. Nitrification is a major pathway for nitrogen removal in lagoons.

A. True B. False

422. Nitrifying bacteria exists in low numbers in lagoons, they prefer attached growth systems and/or?

- A. Nitrifying bacteria D. Aerobic bacteria  
B. Methane forming bacteria E. Anaerobic, heterotrophic bacteria  
C. High MLSS sludge systems F. None of the Above

### **Anaerobic Bacteria**

423. Which of the following bugs or related terms commonly occur in lagoons are involved in methane formation and in sulfate reduction?

- A. Nitrifying bacteria D. Aerobic bacteria  
B. Methane forming bacteria E. Anaerobic, heterotrophic bacteria  
C. Only two bacteria F. None of the Above

424. Anaerobic methane formation involves \_\_\_\_\_ bacteria.

- A. Three different groups of anaerobic D. Organic overloading conditions  
B. Methane fermentation E. Acid-forming bacteria  
C. Methane bacteria F. None of the Above

425. \_\_\_\_\_ many genera of anaerobic bacteria hydrolyze proteins, fats, and polysaccharides present in wastewater to amino acids?

- A. Nitrifying bacteria D. Aerobic bacteria  
B. Methane forming bacteria E. Anaerobic, heterotrophic bacteria  
C. General anaerobic degraders F. None of the Above

### **Photosynthetic Organisms**

426. Which of the following bugs or related terms includes this diverse group of bacteria converts products from above under anaerobic conditions to simple alcohols and organic acids?

- A. BOD and sulfate D. Organic overloading and anaerobic conditions  
B. Methane fermentation E. Acid-forming bacteria  
C. Methane bacteria F. None of the Above

427. Which of the following bugs or related terms these bacteria convert formic acid, methanol, methylamine, and acetic acid under anaerobic conditions to methane?

- A. Nitrifying bacteria
- B. Methane forming bacteria
- C. General anaerobic degraders
- D. Aerobic bacteria
- E. Anaerobic, heterotrophic bacteria
- F. None of the Above

428. A problem exists at times where the acid formers overproduce organic acids, lowering the pH below where the methane bacteria can function (a pH < 6.5). This can stop methane formation and lead to a buildup of sludge in a lagoon with a low pH. In an anaerobic fermenter, this is called a "stuck digester".

- A. True
- B. False

429. Which of the following bugs or related terms are environmentally sensitive and have a narrow pH range of 6.5-7.5 and require temperatures > 14° C.

- A. BOD and sulfate
- B. Methane fermentation
- C. Methane bacteria
- D. Organic overloading and anaerobic conditions
- E. Acid-forming bacteria
- F. None of the Above

430. Which of the following bugs or related terms that the products of these bugs become the substrate for the methane producers?

- A. Nitrifying bacteria
- B. Methane forming bacteria
- C. Acid formers (principally acetic acid)
- D. Aerobic bacteria
- E. Anaerobic, heterotrophic bacteria
- F. None of the Above

### **Activated Sludge Methods**

#### **Organic Load**

431. The organic load (generally coming from primary treatment operations such as settling, screening or flotation) enters the reactor where the active microbial population is present. The reactor must be continuously aerated.

- A. True
- B. False

432. The mixture then passes to a settling tank where the cells are settled. The treated wastewater is disinfected while the secondary settling and is recycled in part to the aeration basin.

- A. True
- B. False

433. According to the text, as the cells are retained longer in the system, the flocculating characteristics of the cells improve since they start to produce extra cellular slime that favors?

- A. Secondary settling
- B. High degradation rate
- C. Flocculating
- D. Organic load
- E. Settled biomass
- F. None of the Above

#### **Common Types**

434. The most common types of activated sludge are the conventional and the continuous flow stirred tank, in which the contents are completely mixed. In the conventional process, the wastewater is circulated along the aeration tank, with the flow being arranged by baffles in plug flow mode. The oxygen demand for this arrangement is maximum at the inlet as is the organic load concentration.

- A. True
- B. False

435. In the completely mixed process the inflow streams are usually introduced at several points to facilitate the homogeneity of the mixing; if the mixing is complete, the properties are constant throughout the reactor.  
A. True      B. False

**Paramecium sp.**

436. Which of the following bugs is a medium to large size (100-300  $\mu\text{m}$ ) swimming ciliate, commonly observed in activated sludge, sometimes in abundant numbers?  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Paramecium  
C. Vorticella      F. None of the Above

437. Which of the following bugs is uniformly ciliated over the entire body surface with longer cilia tufts at the rear of the cell?  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Paramecium  
C. Vorticella      F. None of the Above

438. Paramecium may also be seen paired up with another \_\_\_\_\_ which makes a good diagnostic key.  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Paramecium  
C. Vorticella      F. None of the Above

439. Which of the following bugs is described as a filter-feeding ciliate because its cilia move and filter bacteria from the water?  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Paramecium  
C. Vorticella      F. None of the Above

**Vorticella sp.**

440. Which of the following bugs feeds by producing a vortex with its feeding cilia?  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Paramecium  
C. Vorticella      F. None of the Above

441. According to the text, if treatment conditions are bad, for example, low DO or toxicity, \_\_\_\_\_ will leave their stalks.  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Ciliate  
C. Vorticella      F. None of the Above

442. Which of the following bugs are present when the plant effluent quality is high?  
A. Shelled amoeba(s)      D. Stalked ciliate  
B. Euglypha      E. Paramecium  
C. Vorticella      F. None of the Above

443. According to the text, Vorticella is a?  
A. Mixed liquor            D. Free-swimming and stalked ciliate(s)  
B. Bacteria                E. Contracting stalk  
C. Stalked ciliate        F. None of the Above

444. According to the text, Vorticella are oval to round shaped, have a contractile stalk, a domed feeding zone, and a water vacuole located near the terminal end of the false foot.  
A. True            B. False

445. After reproducing, the offspring develops a band of swimming cilia and goes off to form its own stalk, the evicted organism is called a?  
A. Shelled amoeba(s)        D. Swarmer  
B. Euglypha                E. Paramecium  
C. Vorticella                F. None of the Above

**Euglypha sp.**

446. Which of the following bugs spines may be single or in groups of two or three?

- A. Shelled amoeba(s)        D. Stalked ciliate  
B. Euglypha                E. Paramecium  
C. Vorticella                F. None of the Above

447. The shell of this bug is often transparent, allowing the hyaline body to be seen inside the shell.

- A. Euglypha                D. Euchlanis  
B. Shelled amoeba(s)        E. Spirochaetes  
C. Rotifer(s)                F. None of the Above

448. Which of the following bugs are common in soil, treatment plants, and stream bottoms where decaying organic matter is present?

- A. Shelled amoeba(s)        D. Stalked ciliate  
B. Euglypha                E. Paramecium  
C. Vorticella                F. None of the Above

449. Which of the following bugs is a shelled amoeba?

- A. Shelled amoeba(s)        D. Stalked ciliate  
B. Euglypha                E. Paramecium  
C. Vorticella                F. None of the Above

450. Which of the following bugs have a rigid covering that is either secreted or built from sand grains or other extraneous materials?

- A. Euglypha                D. Euchlanis  
B. Shelled amoeba(s)        E. Spirochaetes  
C. Rotifer(s)                F. None of the Above

**Euchlanis sp.**

451. Euchlanis is a swimmer, using its foot and cilia for locomotion. In common with other rotifers, it has a head rimmed with cilia, a transparent body, and a foot with two strong swimming toes.

- A. True            B. False



452. This microscopic animal is a typical?
- A. Euglypha
  - B. Shelled amoeba(s)
  - C. Rotifer(s)
  - D. Euchlanis
  - E. Spirochaetes
  - F. None of the Above

453. Which of the following bugs is an omnivore, meaning that its varied diet includes detritus, bacteria, and small protozoa?
- A. Euglypha
  - B. Shelled amoeba(s)
  - C. Rotifer(s)
  - D. Euchlanis
  - E. Spirochaetes
  - F. None of the Above

454. Which of the following bugs has a glassy shell secreted by its outer skin?
- A. Euglypha
  - B. Shelled amoeba(s)
  - C. Rotifer(s)
  - D. Euchlanis
  - E. Spirochaetes
  - F. None of the Above

455. A characteristic of this creature is their mastax?
- A. Euglypha
  - B. Shelled amoeba(s)
  - C. Rotifer(s)
  - D. Euchlanis
  - E. Spirochaetes
  - F. None of the Above

456. According to the text, Euchlanis is commonly found in?
- A. Biofilm bacteria
  - B. Filamentous bacteria
  - C. Some bacteria
  - D. Activated sludge
  - E. An omnivore
  - F. None of the Above

### **Bacteria Section**

457. Bacteria come in a variety of shapes. The simplest shape is a round sphere or ball. Bacteria formed like this are called Cocci (singular coccus).

- A. True
- B. False

458. Some bacteria are basically rods but instead of being straight they are twisted, bent or curved, sometimes in a?

- A. Cocci
- B. Rods
- C. Balls
- D. Spiral
- E. Spirochaetes
- F. None of the Above

459. Which of the following terms is tightly coiled up bacteria?

- A. Cocci
- B. Rods
- C. Balls
- D. Spiral
- E. Spirochaetes
- F. None of the Above

460. When bacteria live in chains, one after the other, they are called \_\_\_\_\_ - these often have long thin cells.

- A. Biofilm bacteria
- B. Filamentous bacteria
- C. Some bacteria
- D. Activated sludge
- E. An omnivore
- F. None of the Above

461. Many bacteria exist as \_\_\_\_\_ and the study of biofilms is very important.

- A. Filamentous Bacteria
- B. A biofilm
- C. Application-specific bacteria
- D. Either anaerobic or aerobic conditions
- E. Anaerobic to aerobic state
- F. None of the Above

462. Which of the following terms secrete sticky substances that form a sort of gel in which they live?

- A. Biofilm bacteria
- B. Filamentous bacteria
- C. Some bacteria
- D. Activated sludge
- E. An omnivore
- F. None of the Above

### **Filamentous Bacteria**

463. Which of the following terms are a type of bacteria that can be found in a wastewater treatment system?

- A. Filamentous Bacteria
- B. Facultative
- C. Application-specific bacteria
- D. Either anaerobic or aerobic conditions
- E. Anaerobic to aerobic state
- F. None of the Above

464. According to the text, filamentous Bacteria function similar to \_\_\_\_\_ since they degrade BOD quite well.

- A. Biofilm bacteria
- B. Filamentous bacteria
- C. Some bacteria
- D. Activated sludge
- E. Floc forming bacteria
- F. None of the Above

465. According to the text, filaments are \_\_\_\_\_ that grow in long thread-like strands or colonies.

- A. Bacteria
- B. Facultative Bacteria
- C. Application-specific bacteria
- D. Bacteria and fungi
- E. Anaerobic to aerobic state Bacteria
- F. None of the Above

### **Site Specific Bacteria**

466. Aeration and biofilm building are the key operational parameters that contribute to the efficient degradation of organic matter (BOD/COD removal).

- A. True
- B. False

467. Which of the following terms become site-specific as the biofilm develops and matures and is even more efficient in treating the site-specific waste stream?

- A. Anaerobic action
- B. Absence of free oxygen
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

### **Facultative Bacteria**

468. Most of the bacteria absorbing the organic material in a wastewater treatment system are facultative in nature, meaning they are adaptable to survive and multiply in either anaerobic or aerobic conditions.

- A. True
- B. False

469. According to the text, usually, facultative bacteria will be \_\_\_\_\_ unless there is some type of mechanical or biochemical process used to add oxygen to the wastewater.

- A. Anaerobic
- B. Absence of free oxygen
- C. Facultative bacteria
- D. Aerobic
- E. Application-specific bacteria
- F. None of the Above

470. According to the text, when bacteria are in the process of being transferred from one environment to another, the metamorphosis from \_\_\_\_\_ (and vice versa) takes place within a couple of hours.

- A. Filamentous Bacteria
- B. Facultative
- C. Application-specific bacteria
- D. Either anaerobic or aerobic conditions
- E. Anaerobic to aerobic state
- F. None of the Above

### **Anaerobic Bacteria**

471. Which of the following terms live and reproduce in the absence of free oxygen?

- A. Anaerobic action
- B. Anaerobic bacteria
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

472. In order to remove a given amount of organic material in an anaerobic treatment system, the organic material must be exposed to a \_\_\_\_\_ and/or detained for a much longer period of time.

- A. Anaerobic action
- B. Absence of free oxygen
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Significantly higher quantity of bacteria
- F. None of the Above

473. A typical use for these bugs would be in a septic tank.

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Anaerobic bacteria
- E. Biosurfactant trehalose
- F. None of the Above

474. Which of the following terms or bugs release hydrogen sulfide as well as methane gas, both of which can create hazardous conditions?

- A. Filamentous Bacteria
- B. Anaerobic bacteria
- C. Application-specific bacteria
- D. Either anaerobic or aerobic conditions
- E. Anaerobic to aerobic state
- F. None of the Above

475. Which of the following terms begins in the collection lines of a sewer system, causing deadly hydrogen sulfide or explosive methane gas can accumulate and be life threatening?

- A. Anaerobic action
- B. Absence of free oxygen
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

### **Aerobic Bacteria**

476. Aerobic bacteria live and multiply in the presence of free oxygen.

- A. True
- B. False

477. Facultative bacteria always achieve an aerobic state when oxygen is present.

- A. True
- B. False

478. The metabolism of aerobes is much higher than?

- A. Anaerobic action
- B. Anaerobes
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

479. The by-products of \_\_\_\_\_ are carbon dioxide and water.

- A. Anaerobic action
- B. Absence of free oxygen
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

480. Which of the following terms or bugs live in colonial structures called floc?

- A. Anaerobic action
- B. Absence of free oxygen
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

481. With the mechanical nature of the \_\_\_\_\_, maintenance and operator oversight are required.

- A. Aerobic digestion process
- B. Facultative
- C. Application-specific bacteria
- D. Either anaerobic or aerobic conditions
- E. Anaerobic to aerobic state
- F. None of the Above

### Protozoans and Metazoans

482. In a wastewater treatment system, the next higher life form above bacteria is?

- A. Nematodes and rotifers
- B. Metazoan(s)
- C. Protozoan(s)
- D. Protozoan and metazoan
- E. Aerobic floc
- F. None of the Above

### Dispersed Growth

483. Dispersed growth is material suspended within the activated sludge process that has not been adsorbed into the floc particles. This material consists of very small quantities of colloidal (too small to settle out) bacteria as well as organic and inorganic particulate material.

- A. True
- B. False

484. According to the text, while a small amount of \_\_\_\_\_ between the floc particles is normal, excessive amounts can be carried through a secondary clarifier.

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Dispersed growth
- E. Anaerobic sludge
- F. None of the Above

### Activated Sludge Aerobic Flocs

485. Aerobic flocs in a healthy state are referred to as activated sludge. While aerobic floc has a metabolic rate approximately 10 times higher than anaerobic sludge, it can be increased even further by exposing the bacteria to an abundance of oxygen.

- A. True
- B. False

486. Wastewater treatment efficiencies and removal levels are so much improved that additional downstream treatment components are?

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Dramatically reduced or totally eliminated
- F. None of the Above

**Problems may appear during the operation of activated sludge systems, including:**

487. Which of the following terms' content in clarified effluent, which may be due to too high or too low solids retention time and to growth of filamentous microorganisms?

- A. Organic material
- B. High solids
- C. Macroinvertebrates
- D. Biomass health and effluent quality
- E. Aerobic flocs
- F. None of the Above

488. Which of the following wastewater treatment related terms occurs when sludge that normally settles rises back to the surface after having settled?

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Rising sludge
- F. None of the Above

489. Which of the following wastewater treatment related terms settles too slowly and is not compactable, and caused by the predominance of filamentous organisms?

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Anaerobic sludge
- F. None of the Above

490. According to the text, insufficient reduction of organic load, probably caused by a \_\_\_\_\_, insufficient amount of nutrients such as P or N?

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Low solids retention time
- E. Biosurfactant trehalose
- F. None of the Above

491. Odors, caused by \_\_\_\_\_ in the settling tanks or insufficient aeration in the reactor.

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Anaerobic conditions
- F. None of the Above

**Filamentous Organisms**

492. Which of the following wastewater treatment related terms reach too high a concentration, they can extend dramatically from the floc particles?

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Process control variation
- E. Biosurfactant trehalose
- F. None of the Above

493. Which of the following wastewater treatment related terms, because of the increased surface area and without a corresponding increase in mass, this will not settle well?

- A. Larger floc particles
- B. Activated sludge
- C. Floating scum mat
- D. Biomass
- E. Filaments
- F. None of the Above

**Filamentous Bacteria Identification**

494. Filamentous Identification should be used as a tool to monitor the health of the biomass when a floating scum mat is suspected.

- A. True
- B. False

495. *Nocardia amarae*, a common cause of Gram-positive, chemoautotrophic, filamentous in waste treatment plants, is a slow growing, usually gram-positive, chemoautotrophic, filamentous, strict aerobe that produces the biosurfactant trehalose.

- A. True      B. False

496. *Nostocoida limicola* is yet another common cause of disruptive foaming in waste treatment plants, motile in its Hormogonia and sometimes Trichome phases. This oxygenic phototrophic species often forms multicellular rigid filaments, forming non-symbiotic relationships with other species.

- A. True      B. False

497. *Thiothrix* are considered which term, using several small organic carbons and reduced inorganic sulfur sources for growth and energy?

- A. Viscous brown color      D. Gram-positive, chemoautotrophic, filamentous  
B. Staining gram-positive      E. Disruptive foaming  
C. Mixotrophic      F. None of the Above

498. *Microthrix parvicella* is another common cause of?

- A. Viscous brown color      D. Gram-positive, chemoautotrophic, filamentous  
B. Staining gram-positive      E. Disruptive foaming  
C. Mixotrophic      F. None of the Above

499. *Sphaeroliticus natans* is another filamentous species, and yet it is reputed to increase settleability by branching between flocs, increasing surface area.

- A. True      B. False

### **Biochemical Oxygen Demand**

500. Which of the following terms reflects high concentrations of substances that can be biologically degraded, thereby consuming oxygen?

- A. Organic carbon      D. High BOD  
B. Human sources      E. Growth of filamentous bacteria  
C. Domestic wastewater      F. None of the Above