

**Registration form**

**Wastewater Treatment Bugs Training Course \$100.00  
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*

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**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.*

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Toll Free (866) 557-1746 Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)**

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## **DISCLAIMER NOTICE**

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**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.

*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.

**Do not solely depend on TLC's Approval list for it may be outdated.**

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

# Wastewater Treatment Bugs 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 \_\_\_\_\_

Do not solely depend on TLC's Approval list for it may be outdated.

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

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

*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.*

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

**WASTEWATER TREATMENT BUGS  
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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# Wastewater Treatment Bugs

## 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.

**Multiple Choice, please select only one answer per question. There are no intentional trick questions.**

1. Which of the following terms is BOD, TSS, fecal coliform, oil and grease, and pH?  
A. Daily Maximum Limitations  
B. Continuous Discharge  
C. Concentration-based Limit  
D. Control Authority  
E. Conventional Pollutants  
F. None of the Above
2. Which of the following terms is a State with an NPDES permit program approved pursuant to section 402(b) of the Act and an approved State Pretreatment Program?  
A. Approved State Pretreatment Program  
B. Approved/Authorized State  
C. Act or "the Act"  
D. Approval Authority  
E. Approved POTW Pretreatment Program or Program  
F. None of the Above
3. Which of the following terms is a report submitted by categorical industrial users (CIUs) within 180 days after the effective date of an applicable categorical standard?  
A. Best Professional Judgment (BPJ)  
B. Baseline Monitoring Report (BMR)  
C. Best Management Practices (BMPs)  
D. Best Practicable Control Technology Currently Available (BPT)  
E. None of the Above
4. Which of the following terms is a discharge of untreated wastewater from a combined sewer system at a point prior to the headworks of a publicly owned treatment works?  
A. Code of Federal Regulations (CFR)  
B. Chronic  
C. Combined Sewer Overflow (CSO)  
D. Clean Water Act (CWA)  
E. None of the Above

5. Which of the following terms is a program administered by a POTW that meets the criteria established in 40 CFR Part 403?
- A. Approved State Pretreatment Program
  - B. Approved/Authorized State
  - C. Act or "the Act"
  - D. Approval Authority
  - E. Approved POTW Pretreatment Program or Program
  - F. None of the Above
6. Which of the following terms is a record of each person involved in the possession of a sample from the person who collects the sample to the person who analyzes the sample in the laboratory?
- A. Blowdown
  - B. Categorical Industrial User (CIU)
  - C. Bypass
  - D. Chain of Custody (COC)
  - E. None of the Above
7. Which of the following terms is a stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more?
- A. Code of Federal Regulations (CFR)
  - B. Chronic
  - C. Combined Sewer Overflow (CSO)
  - D. None of the Above
8. Which of the following terms is the common name for the Federal Water Pollution Control Act. Public law 92-500?
- A. Code of Federal Regulations (CFR)
  - B. Chronic
  - C. Combined Sewer Overflow (CSO)
  - D. Clean Water Act (CWA)
  - E. None of the Above
9. Which of the following terms is discharge that occurs without interruption during the operating hours of a facility, except for infrequent shutdowns for maintenance, process changes or similar activities?
- A. Daily Maximum Limitations
  - B. Continuous Discharge
  - C. Concentration-based Limit
  - D. Control Authority
  - E. Conventional Pollutants
  - F. None of the Above
10. Which of the following terms is the maximum allowable discharge of pollutants during a 24-hour period?
- A. Daily Maximum Limitations
  - B. Continuous Discharge
  - C. Concentration-based Limit
  - D. Control Authority
  - E. Conventional Pollutants

11. Which of the following terms is the minimum concentration of an analyte that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero?

- A. Detection Limit
- B. Development Document
- C. Dilute Wastestream
- D. None of the Above

12. Which of the following terms is a combination of individual samples proportional to the flow of the wastestream at the time of sampling?

- A. Federal Water Pollution Control Act
- B. Flow Weighted Average Formula (FWA)
- C. Existing Source
- D. Enforcement Response Plan
- E. Flow Proportional Composite Sample
- F. None of the Above

13. A sample that is taken from a wastestream on a one-time basis with no regard to the flow of the wastestream and without consideration of time.

- A. Grab Sample
- B. Fundamentally Different Factors
- C. General Prohibitions
- D. Indirect Discharge or Discharge
- E. None of the Above

### **Basic Wastewater Treatment Processes**

14. 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

15. One of the physical processes for wastewater treatment involves removal of particles that float on top of the water because they have \_\_\_\_\_.

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

### **Biological**

16. The process of saturating sewage with air and microorganisms to break down the organic matter is called \_\_\_\_\_.

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

17. Wastewater treatment levels beyond secondary treatment are referred to as \_\_\_\_\_.

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

18. Bacteria naturally found in water will 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

19. In the 1920s, scientists figured out how to contain and accelerate \_\_\_\_\_ to remove organic material from wastewater.

- A. These natural biological processes
- B. Activated Sludge
- C. Chemicals
- D. Organic material
- E. Entrapped air
- F. None of the Above

20. The addition of \_\_\_\_\_ to the biological process causes masses of microorganisms to grow and rapidly metabolize organic materials.

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

### Organic Matter

21. Which of the following terms, such as proteins, carbohydrates, or fats, can cause pollution of receiving waters?

- A. Long chained compounds
- B. Organics
- C. Inorganic materials
- D. Wastewater-related sources
- E. Oxygen compounds
- F. None of the Above

22. Organisms use dissolved oxygen in the water to break down biodegradable materials. This process is dangerous to aquatic life because the \_\_\_\_\_ in the water is reduced or depleted.

- A. Sediment
- B. Supply of oxygen
- C. Hydrogen
- D. Graywater and blackwater
- E. Nitrogen
- F. None of the Above

23. 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

24. Many \_\_\_\_\_ used by agriculture and industries cannot be quickly broken down by organisms, making treatment more difficult.

- A. Inorganic substances
- B. Organic materials
- C. Organic compounds
- D. Graywater and blackwater
- E. Synthetic organic compounds
- F. None of the Above

25. Certain synthetic organics, such as \_\_\_\_\_, are toxic to humans, fish, and aquatic plants.

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

26. Solvents and pesticides contain toxic \_\_\_\_\_ such as benzene and toluene.
- A. Nutrients from wastewater
  - B. Inorganic materials
  - C. Inorganic minerals
  - D. Excessive grease
  - E. Organic compounds
  - F. None of the Above

### Oil and Grease

27. Fatty organic materials from animals, vegetables, and petroleum are quickly broken down by bacteria and therefore are not a source of pollution.
- A. True
  - B. False

28. 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

29. Hazardous wastes such as \_\_\_\_\_ 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

30. The \_\_\_\_\_ of receiving waters is increased when large amounts of oils and greases are discharged from community systems.
- A. BOD
  - B. Inorganic substances
  - C. Nitrogen and phosphorus
  - D. Bacteria
  - E. Petroleum-based waste oils
  - F. None of the Above

### Inorganics

31. Organisms in wastewater cannot easily break down \_\_\_\_\_, since these substances are relatively stable.
- A. Most organic substances
  - B. Most inorganic substances
  - C. Nitrogen and phosphorus
  - D. Pesticides and herbicides
  - E. Petroleum-based waste oils
  - F. None of the Above

32. The removal of \_\_\_\_\_ from industrial wastewater sources often requires additional treatment steps.
- A. Nutrients from wastewater
  - B. Inorganic materials
  - C. Organic materials
  - D. BOD
  - E. DON
  - F. None of the Above

33. Heavy metals in industrial wastewater discharges are difficult to remove by conventional treatment methods.
- A. True
  - B. False

34. Residential and nonresidential sources both contribute inorganic minerals, metals, and compounds to wastewater.
- A. True
  - B. False

## Nutrients

35. 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

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

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

37. Which of the following 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    D. Pesticides and herbicide(s)  
B. Most inorganic substances                      E. Nitrogen  
C. Phosphorus    F. None of the Above

38. 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                      D. Nutrients nitrogen and phosphorus  
B. Inorganic materials                                E. Nitrogen and phosphorus  
C. Inorganic minerals                                 F. None of the Above

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

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

## Solids

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

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

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

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

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

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

43. The solids must be significantly reduced by treatment or they can increase \_\_\_\_\_ when discharged to receiving waters?

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

44. 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

45. 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

46. 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

47. 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

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

- A. True
- B. False

### **Gases**

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

- A. True
- B. False

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

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

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

51. Aquatic life needs \_\_\_\_\_ in the water to survive.

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

52. The biochemical oxygen demand (BOD) of the effluent is not an indicator of how well a sewage treatment plan is working.

- A. True    B. False

53. If the wastewater treatment plant effluent has a high content of organics or ammonia, more \_\_\_\_\_ will be demanded from the receiving water. This will leave less oxygen to support fish and aquatic plants.

- A. Slime bacteria                      D. Nitrogen  
B. Wastewater odors                  E. Oxygen  
C. Hydrogen sulfide                  F. None of the Above

54. Organic matter and \_\_\_\_\_ are "oxygen-demanding" substances.

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

55. Domestic sewage and \_\_\_\_\_ all contribute oxygen-demanding substances to wastewater.

- A. Slime bacteria                              D. The lack of oxygen  
B. Wastewater odors                        E. Agricultural and industrial wastes  
C. Hydrogen sulfide                        F. None of the Above

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

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

### **Pathogens**

57. Modern disinfection techniques for wastewater and drinking water have greatly reduced the danger of waterborne disease.

- A. True    B. False

### **Nutrients**

58. \_\_\_\_\_ are essential to living organisms and are the chief nutrients present in natural water?

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

59. Aquatic plants and animals are harmed when uncontrolled algae growth blocks out the sunlight, thereby depleting \_\_\_\_\_ in the water at night.

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



60. When a waterbody cannot assimilate all of the nutrients, the resulting condition is called \_\_\_\_\_.

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

61. \_\_\_\_\_ 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

62. According to the text, Carbon, nitrogen, and phosphorus are essential to living organisms and are the chief nutrients present in natural water.

- A. True
- B. False

63. An excess of nitrogen and phosphorous causes water plants to grow slowly.

- A. True
- B. False

64. Large amounts of nutrients, primarily \_\_\_\_\_ but sometimes nitrogen, cause nutrient enrichment that leads to excessive algae growth.

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

### Thermal

65. The capacity of water to retain oxygen is reduced by \_\_\_\_\_.

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

66. The ecology of a lake or stream can be seriously altered by uncontrolled discharges of \_\_\_\_\_.

- A. Toxics
- B. Waste heat
- C. Nutrients
- D. Oxygen
- E. Phosphorus and nitrogen
- F. None of the Above

67. 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

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

- A. True
- B. False

69. The primary treatment stage removes coarse solids from the wastewater. In some treatment plants, the \_\_\_\_\_ are combined into one 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

70. Many wastewater treatment plants have preliminary treatment units before primary and secondary treatment begins.

- A. True B. False

71. Which of the following terms are used in the secondary treatment stage to further purify wastewater?

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

### **Preliminary Treatment**

72. After coarse screening, the wastewater may flow into a grit chamber to remove sand, grit, cinders, and small stones.

- A. True B. False

73. It is very important to remove \_\_\_\_\_ that washes off city streets or land during storms, especially in cities with combined sewers.

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

74. 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

75. The \_\_\_\_\_ from the collection system enters into the coarse screening process.

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

76. Treatment plant pumps and other equipment can be damaged by large amounts of \_\_\_\_\_ entering the plant.

- A. Solids D. Grit and sand  
B. Finer debris E. Dissolved organic and inorganic constituents  
C. Inorganics F. None of the Above

77. In some wastewater treatment plants, another finer screen is used after the grit chamber to remove additional material that may damage equipment.

- A. True B. False

### **Primary Sedimentation**

78. Pollutants that are dissolved in the wastewater are effectively removed by gravity settling.

- A. True B. False

79. When the wastewater flow is slowed down in a sedimentation tank, the suspended solids gradually sink to the bottom. The resulting mass of solids is called \_\_\_\_\_.

- A. Very fine solids
- B. Wastewater pollution
- C. Pollutants
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

80. 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

81. 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

82. The wastewater from preliminary treatment flows directly into the secondary clarifier.

- A. True
- B. False

83. Which of the following terms are consumed by microorganisms within the oxidation basins. The microorganisms also adhere to the solids themselves?

- A. Total Solids
- B. TDS
- C. Very fine solids
- D. Grit and screenings
- E. Sludges
- F. None of the Above

84. The microorganisms in the oxidation basins consume and adhere to the finer solids. This causes \_\_\_\_\_ to form, which can be physically separated.

- A. Solids
- B. Finer debris
- C. Grit and gravel
- D. Larger and heavier aggregates
- E. Dissolved organic and inorganic constituents
- F. None of the Above

85. After the primary treatment processes, the \_\_\_\_\_ flows to the secondary treatment processes.

- A. Very fine solids
- B. Wastewater
- C. Pollutant load
- D. Primary sludge
- E. Grit
- F. None of the Above

86. The \_\_\_\_\_ and the suspended growth processes are the most common conventional methods used to achieve secondary treatment.

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

87. The secondary treatment stage includes a biological process, such as \_\_\_\_\_, and a physical process known as secondary clarification.

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

88. After preliminary treatment, the \_\_\_\_\_ are still present in the wastewater, since they cannot be removed by physical processes.
- A. Very fine solids
  - B. Coarse debris
  - C. Grit and gravel
  - D. Suspended growth processes
  - E. Larger debris
  - F. None of the Above

### Secondary Clarification Process

89. The SCP provides quiescent conditions which allow the larger aggregates of solids and microorganisms to settle out for collection.
- A. True
  - B. False

90. In the SCP, the majority of microorganism-rich underflow (or lower layer) 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

### Lagoon Systems

91. 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

92. 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

93. Wastewater characteristics can affect public health, the environment, and 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

94. The best temperatures for wastewater treatment probably range from 77 to 95 degrees Fahrenheit.
- A. True
  - B. False
95. 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

96. Hot water is a byproduct of many manufacturing processes and is not 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

97. The acidity or alkalinity of wastewater affects both treatment and the environment.  
A. True B. False
98. Low pH indicates increasing acidity while a high pH indicates increasing alkalinity.  
A. True B. False
99. In order to protect organisms in the biological process, the \_\_\_\_\_ of the wastewater needs to remain between 6 and 9.  
A. Total Solids D. Elevated Hardness, Salty Taste, or Corrosiveness  
B. TDS E. Wastewater temperature  
C. pH F. None of the Above
100. Industrial or commercial discharges containing acids and other substances can alter the \_\_\_\_\_ of the wastewater and inactivate treatment processes.  
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

101. Pure water is tasteless, colorless, and odorless and is often called “the universal solvent”.  
A. True B. False
102. Which of the following terms is often called the universal solvent because it 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
103. Which of the following 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
104. Inorganic salts and some small amounts of organic matter that are dissolved in water are referred to as \_\_\_\_\_.  
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
105. Total dissolved solids in drinking water come from natural sources, sewage, urban runoff, industrial wastewater, and water treatment chemicals.  
A. True B. False
106. 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

107. Natural environmental features causing elevated \_\_\_\_\_ include mineral springs, carbonate deposits, salt deposits, and seawater intrusion.

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

108. The sum of the cations and anions in the water is the definition of \_\_\_\_\_.

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

109. Water quality issues such as elevated hardness, salty taste, or \_\_\_\_\_ cannot be evaluated using the TDS test.

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

### **Total Solids**

110. \_\_\_\_\_ refers to suspended or dissolved matter in water and wastewater. This property is related to both specific conductance and turbidity.

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

111. Material left inside a container after evaporation and drying of a water sample is called \_\_\_\_\_ (also referred to as total residue).

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

112. 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
- B. TDS
- C. pH
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. Wastewater
- F. None of the Above

113. 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
- B. Total dissolved solids (TDS)
- C. Quality of the water
- D. Total Suspended solids
- E. Wastewater
- F. None of the Above

114. 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)**

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

- A. True
- B. False

116. Because the suspended particles absorb heat and light, \_\_\_\_\_ can raise the surface water temperature. Warmer water can hold less dissolved oxygen, which in turn can harm aquatic life.

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Hydrogen sulfide
- E. Suspended sediment
- F. None of the Above

117. 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

118. \_\_\_\_\_ 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

119. Silt, decaying plant and animal matter, industrial wastes, and sewage are all included in \_\_\_\_\_.

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

120. \_\_\_\_\_ can reduce the amount of light passing through the water to reach submerged vegetation, slowing down photosynthesis.

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

121. 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

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

- A. True
- B. False

123. 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

124. 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

125. \_\_\_\_\_ 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

126. The focus of wastewater treatment plants is to reduce \_\_\_\_\_ 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

127. Treatment of wastewater usually involves \_\_\_\_\_ 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

128. 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

### **Water Quality Criteria**

129. According to the Clean Water Act, water quality criteria developed by the EPA must accurately reflect the latest scientific knowledge about the effects of pollutants on aquatic life and human health.

- A. True
- B. False

130. 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**

131. Humans can be exposed to water pollutants by drinking untreated surface water or eating fish or wildlife that have been contaminated by pollutants in surface water.

- A. True
- B. False

### **Aquatic Life Criteria**

132. The aquatic life criteria developed by EPA are numeric limits on the amounts of chemicals that can be present in the water without harming aquatic life.

- A. True
- B. False

133. Aquatic life criteria do not provide protection for saltwater aquatic organisms.

- A. True
- B. False



134. \_\_\_\_\_ protect aquatic organisms from death, slower growth, reduced reproduction, and the accumulation of toxic chemicals in their tissues.

- A. Aquatic life criteria
- B. Water pollutants
- C. Water quality standards
- D. Concentrations of pollutants
- E. Pollutant levels
- F. None of the Above

### Biological Criteria

135. The natural condition of a water body is to be free from \_\_\_\_\_, habitat loss, and other negative stressors.

- A. Allowable concentrations
- B. The harmful effects of pollution
- C. Water quality standards
- D. Human activity
- E. Aquatic life criteria
- F. None of the Above

136. States can use methodologies developed by EPA to develop protective \_\_\_\_\_ for their waters.

- A. Toxic pollutants
- B. Food chains
- C. Biological integrity
- D. Biological treatments
- E. Water quality standards
- F. None of the Above

137. EPA methodologies describe \_\_\_\_\_ for determining the health of an aquatic community.

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

### Summary

138. 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

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

- A. True
- B. False

140. The microorganisms used are responsible for the degradation of this 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

141. 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

### Genera

142. 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

143. 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

144. 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

145. 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

146. The biological treatment processes used for wastewater treatment are broadly classified as aerobic in which aerobic and facultative micro-organisms 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

147. \_\_\_\_\_ means the microorganisms that are attached to a surface over which they grow are called "attached growth processes"?

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

### **Aerobic Processes**

148. Activated sludge systems, lagoons, trickling filters and rotating disk contactors are the most common aerobic processes.

- A. True
- B. False

149. In wastewater treatment, carbonaceous BOD is degraded using \_\_\_\_\_.

- 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

150. Pilot plant and laboratory studies are required to design \_\_\_\_\_.

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

151. An activated sludge process can be designed based on the amount of time the sludge spends in the system. This is referred to as the \_\_\_\_\_.

- 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

### Wastewater and Pretreatment Compliance Monitoring

152. 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

153. \_\_\_\_\_ - 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

154. 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

155. 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

156. 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

157. On a periodic basis (i.e., once every two to three years), 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

158. 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**

159. 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

160. 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

161. 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

162. 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

163. 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

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

#### **General**

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

- A. True
- B. False

165. 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

166. 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

167. 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

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

- A. True
- B. False

169. 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

170. 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**

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

- A. True
- B. False

172. 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:**

173. 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

174. 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

175. 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

176. Which of the following sampling terms - 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

177. 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

178. 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

179. 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

180. 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

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

- A. True
- B. False

### Wastewater Sample Preservation

182. 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

183. According the text, sample preservation is needed for \_\_\_\_\_, 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**

184. According to the text, Quality Assurance/Quality Control measures taken by the sampling crew include equipment blanks, trip blanks, split samples and duplicate samples.

- A. True    B. False

**Chain-of-Custody**

185. The collection, preservation and transportation of samples and all documentation is critical to the overall success of the Wastewater Sampling Program.

- A. True    B. False

**Proper Sample Handling**

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

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

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

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

188. 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?

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

189. 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

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

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

**Field Parameters**

191. 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                      D. Dissolved oxygen  
B. Nitrogen                                  E. Activated sludge  
C. Total Nitrogen (TN)                  F. None of the Above

## Dissolved Oxygen

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

A. True B. False

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

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

194. The saprophytes exist on dead or decaying materials.

A. True B. False

195. 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

196. Aerobic bacteria do not require oxygen in which to live and thrive.

A. True B. False

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

A. True B. False

198. Dissolved oxygen in water is considered a contaminant.

A. True B. False

199. 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

200. 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

201. 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

202. 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



### Sludge Volume Index (SVI)

203. 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

204. The Sludge Volume Index of activated sludge is defined as the volume in milliliters occupied by \_\_\_\_\_ after settling for 30 minutes.

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

### Microorganisms in Lagoons

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

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

206. Which of the following 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) D. Floc-forming bacteria  
B. Aerobic bacteria E. Filamentous bacteria  
C. Stalked ciliate(s) F. None of the Above

207. The omnivores, such as most of which bugs, eat whatever is readily available, while these creatures on the floc or prey on larger organisms?

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

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

209. Food (organic loading) regulates?

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

### Aerobic Bacteria - Microorganisms in Lagoons and Activated Sludge

210. Three functional groups of aerobic bacteria found in the activated sludge process are: freely dispersed, single bacteria; floc-forming bacteria; and filamentous bacteria.

- A. True B. False

211. Which of the following terms 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

212. \_\_\_\_\_ grow in a large aggregate (floc).

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

213. \_\_\_\_\_, 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

214. The floc-forming bacteria degrade \_\_\_\_\_ and settle at the end of the process, resulting in a low TSS effluent.

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

215. \_\_\_\_\_ can be found in lagoons at specific growth locations.

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

216. Filamentous bacteria do not cause operational problems in lagoons, but cause filamentous bulking and \_\_\_\_\_ in activated sludge processes.

- A. Strict aerobes
- B. Predators
- C. Bacteria
- D. Poor sludge settling
- E. Many bacterial species
- F. None of the Above

217. Aerobic BOD removal doesn't work very well from pH 6.5 to 9.0 and at temperatures from 3-4°C to 60-70°C

- A. True
- B. False

218. BOD removal decreases rapidly below 3-4°C and ceases at 1-2°C.

- A. True
- B. False

219. Ammonia can be oxidized to nitrate by \_\_\_\_\_.

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

### **Aerated lagoons**

220. 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

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

A. True B. False

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

### **Nitrification**

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

A. True B. False

224. 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                 |

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

A. True B. False

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

A. True B. False

227. 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**

228. 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                 |

229. Anaerobic methane formation involves \_\_\_\_\_ bacteria.
- A. Three different groups of anaerobic
  - B. Methane fermentation
  - C. Methane bacteria
  - D. Organic overloading conditions
  - E. Acid-forming bacteria
  - F. None of the Above

230. Which of the following bugs or related terms many genera of anaerobic bacteria hydrolyze proteins, fats, and polysaccharides present in wastewater to amino acids?
- A. Nitrifying bacteria
  - B. Methane forming bacteria
  - C. General anaerobic degraders
  - D. Aerobic bacteria
  - E. Anaerobic, heterotrophic bacteria
  - F. None of the Above

### Photosynthetic Organisms

231. 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
  - B. Methane fermentation
  - C. Methane bacteria
  - D. Organic overloading and anaerobic conditions
  - E. Acid-forming bacteria
  - F. None of the Above

232. 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

233. 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).
- A. True
  - B. False

234. 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

235. 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

236. Which of the following bugs or related terms ceases at cold temperature?
- 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

237. Which of the following bugs or related terms can use sulfate as an electron acceptor, reducing sulfate to hydrogen sulfide?

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

238. Which of the following bugs or related terms is a major cause of odors in ponds?

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

239. Which of the following bugs or related terms are represented by about 28 genera, oxidize reduced sulfur compounds using light energy to produce sulfur and sulfate?

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

240. Which of the following bugs or related terms, which can grow in profusion and give a lagoon a pink or red color?

- A. Chromatium, Thiocystis, and Thiopedia
- B. Methane fermentation
- C. Methane bacteria
- D. Organic overloading
- E. Acid-forming bacteria
- F. None of the Above

241. According to the text, conversion of odorous sulfides to sulfur and sulfate by these bugs is a significant odor control mechanism in facultative and anaerobic lagoons.

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

### **Protozoans and Microinvertebrates**

242. Many higher life forms (animals) develop in lagoons. These include protozoans and microinvertebrates such as rotifers, daphnia, annelids, chironomids, and mosquito larvae.

- A. True
- B. False

243. Which of the following bugs or related terms best describe the most common higher life forms in lagoons with about 250 species identified in lagoons to date?

- A. Mosquitoes
- B. Bacteria and algae
- C. Protozoans
- D. Rotifers and daphnia
- E. Culex tarsalis
- F. None of the Above

244. Which of the following bugs or related terms best describe important at controlling algal overgrowth and these often "bloom" when algal concentrations are high?

- A. Mosquitoes
- B. Bacteria and algae
- C. Protozoans
- D. Rotifers and daphnia
- E. Culex tarsalis
- F. None of the Above

245. Which of the following bugs or related terms best describe relatively slow growing and only occur in systems with a detention time of >10 days?

- A. Mosquitoes
- B. Bacteria and algae
- C. Protozoans
- D. Rotifers and daphnia
- E. Microinvertebrates
- F. None of the Above

246. The requirement for a minimum lagoon bank slope and removal of shoreline vegetation by most regulatory agencies is based on the public health need to reduce mosquito vectors.

- A. True
- B. False

### Activated Sludge Methods- Organic Load

247. The organic loading from primary treatment processes enters the reactor (aeration basin) where the active microbial population is present.

- A. True
- B. False

248. The mixture of wastewater, oxygen, and microorganisms flows from the aeration basin to a secondary clarifier where the cells are settled. The settled microorganisms are also called waste activated sludge.

- A. True
- B. False

249. 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

250. In the conventional activated sludge process, baffles in the aeration tank cause the wastewater to circulate along the aeration tank in \_\_\_\_\_.

- A. Plug flow mode
- B. Laminar flow mode
- C. 24 to 48 hours
- D. Higher organic load
- E. Settled biomass
- F. None of the Above

### Paramecium sp.

251. Paramecium is a \_\_\_\_\_ commonly present in activated sludge. It is medium to large size (100-300  $\mu\text{m}$ ).

- A. Shelled amoebas
- B. Euglypha
- C. Vorticella
- D. Stalked ciliate
- E. Swimming ciliate
- F. None of the Above

252. Paramecium is \_\_\_\_\_ over the entire body surface, allowing it to swim with a smooth gliding motion.

- A. Round-shaped
- B. Inflexible
- C. Vorticella
- D. Stalked
- E. Uniformly ciliated
- F. None of the Above

253. Paramecium may also be seen paired up with another \_\_\_\_\_ which makes a good diagnostic key.

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

**Vorticella sp.**

254. Which of the following bugs feeds by producing a vortex with its feeding cilia?

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

255. According to the text, if treatment conditions are bad, for example, low DO or toxicity, \_\_\_\_\_ will leave their stalks.

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

**Euglypha sp.**

256. Euglypha are \_\_\_\_\_ with jelly-like bodies and range in size from 70 to 100  $\mu\text{m}$ .

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

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

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

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

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

**Euchlanis sp.**

259. 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

260. Euchlanis is a typical \_\_\_\_\_. It uses cilia rimmed around its head and a foot with two strong swimming toes for locomotion. It also has a transparent body.

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

261. 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

262. 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

263. 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

264. The presence of Euchlanis in \_\_\_\_\_ is evidence that aerobic conditions have been sustained, and that effluent quality is good.

- A. Biofilm
- B. Plant effluent
- C. Some bacteria
- D. Activated sludge
- E. Wastewater
- F. None of the Above

### Bacteria Section

265. Bacteria shapes can be round spheres (cocci), cylindrical (rods), or twisted, bent, or curved rods (spirilla).

- A. True
- B. False

266. Bacteria do not live alone, but live together in clumps, chains, or planes.

- A. True
- B. False

267. Tightly coiled up bacteria are called \_\_\_\_\_.

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

268. \_\_\_\_\_ live in chains, one after the other, and often have long thin cells.

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

269. A plane or thin layer of bacteria over the surface of an object is called \_\_\_\_\_.

- 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

### Filamentous Bacteria

270. The floc structure created by filamentous bacteria keeps the floc from breaking up or shearing due to the turbulence from pumps, aeration, or transfer of the water.

- A. True
- B. False



271. 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

272. 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

273. The efficient degradation of organic matter depends on two key operational parameters – aeration and biofilm building.

- A. True
- B. False

### Facultative Bacteria

274. Facultative bacteria can survive and multiply in either anaerobic or aerobic conditions.

- A. True
- B. False

275. 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

### Anaerobic Bacteria

276. \_\_\_\_\_ live and reproduce when free oxygen is absent.

- A. Site-specific bacteria
- B. Anaerobic bacteria
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

277. Organic material in an anaerobic treatment system must be exposed to \_\_\_\_\_ and/or detained for a much longer period of time to remove a given amount of organic material.

- A. Nitrogen
- B. Free oxygen
- C. Air
- D. Aerobic bacteria
- E. A significantly higher quantity of bacteria
- F. None of the Above

278. Septic tanks use \_\_\_\_\_ to break down organic material.

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

279. \_\_\_\_\_ can be hazardous because they release hydrogen sulfide and methane gas.

- A. Filamentous Bacteria
- B. Anaerobic bacteria
- C. Application-specific bacteria
- D. Either anaerobic or aerobic conditions
- E. Aerobic bacteria
- F. None of the Above

### **Aerobic Bacteria**

280. Aerobic bacteria require free oxygen to live and multiply.

- A. True    B. False

281. Facultative bacteria become aerobic when oxygen is present.

- A. True    B. False

282. Since the metabolism of aerobes is much higher than \_\_\_\_\_, organic material can be removed with 90% fewer organisms or in 90% less time compared to the anaerobic process.

- A. Anaerobic action            D. Aerobic bacteria  
B. Anaerobes                    E. Application-specific bacteria  
C. Facultative bacteria        F. None of the Above

283. The by-products of \_\_\_\_\_ are carbon dioxide and water.

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

### **Protozoans and Metazoans**

284. In a wastewater treatment system, the next higher life form above bacteria is?

- A. Nematodes and rotifers      D. Protozoan and metazoan  
B. Metazoan(s)                    E. Aerobic floc  
C. Protozoan(s)                  F. None of the Above

285. \_\_\_\_\_ are also indicators of biomass health and effluent quality?

- A. Organic material              D. Biomass health and effluent quality  
B. Protozoans                      E. Aerobic flocs  
C. Macroinvertebrates          F. None of the Above

286. \_\_\_\_\_ are very similar to protozoans except that they are usually multi-celled animals?

- A. Nematodes and rotifers      D. Protozoan and metazoan  
B. Metazoan(s)                    E. Aerobic floc  
C. Protozoan(s)                  F. None of the Above

287. \_\_\_\_\_ are typically found only in a well-developed biomass?

- A. Nematodes and rotifers      D. Protozoan and metazoan  
B. Metazoan(s)                    E. Macroinvertebrates  
C. Protozoan(s)                  F. None of the Above

288. \_\_\_\_\_ and the relative abundance of certain species can be a predictor of operational changes within a treatment plant?

- A. Nematodes and rotifers      D. Protozoans and metazoans  
B. Metazoan(s)                    E. Macroinvertebrates  
C. Protozoan(s)                  F. None of the Above

### **Dispersed Growth**

289. Dispersed growth is material suspended within the activated sludge process that has not been adsorbed into the floc particles.

A. True B. False

290. 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**

291. 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

292. 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:**

293. 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

294. 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

295. Which of the following wastewater treatment related terms that 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

### **Filamentous Organisms**

296. 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

### Filamentous Bacteria Identification

297. 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

298. The foam from *Nocardia amarae* is usually a \_\_\_\_\_ unless algae are entrapped in it, in which case it appears green and brown.

- A. Viscous brown color D. Gram-positive, chemoautotrophic, filamentous  
B. Staining gram-positive E. Disruptive foaming  
C. Mixotrophic F. None of the Above

299. Nostocoida can also be identified by their starburst effect formations using phase contrast microscopy at 400 to 1000x magnification. After chlorination, a few dead cells sticking out identify stress to this species.

A. True B. False

300. According to the text, *Thiothrix II* produces rectangular filaments up to 200 microns in length and is easily identified by their \_\_\_\_\_ using phase contrast microscopy at 400 to 1000x magnification.

- A. Stain gram-negative D. Starburst effect formations  
B. Not casease E. Multicellular rigid filaments  
C. Slower growing filaments F. None of the Above