

*Registration form*

**TERTIARY TREATMENT TRAINING COURSE \$200.00**  
**48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

**Start and finish dates:** \_\_\_\_\_

*You will have 90 days from this date in order to complete this course*

**Name** \_\_\_\_\_ **Signature** \_\_\_\_\_

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

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

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**Email** \_\_\_\_\_ **Fax (\_\_\_\_)** \_\_\_\_\_

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

**Operator ID #** \_\_\_\_\_ **Exp. Date** \_\_\_\_\_

**Class/Grade** \_\_\_\_\_

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

Collection \_\_\_ Wastewater Treatment \_\_\_ Pretreatment \_\_\_ Other \_\_\_\_\_

*Your certificate will be emailed to you in about two weeks unless you pay for the rush service.*

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

**If you've paid on the Internet, please write your Customer#** \_\_\_\_\_

**Please invoice me, my PO#** \_\_\_\_\_

**Please pay with your credit card on our website under Bookstore or Buy Now. Or call us and provide your credit card information.**

*We will stop mailing the certificate of completion so we need either your fax number or e-mail address. We will e-mail the certificate to you, if no e-mail address; we will fax it to you.*

## **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.

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

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity. Thank you...

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

**Some States and many employers require the final exam to be proctored.**

<http://www.abctlc.com/downloads/PDF/PROCTORFORM.pdf>

**A second certificate of completion for a second State Agency \$50 processing fee.**

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

# Tertiary Treatment 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. No refunds.*

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

**Multiple Choice. Pick only one answer per question. Select answer according to text, exactly as in text. Circle, Mark off, underline or Bold the answer.**

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

*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.*

**Rush Grading Service**

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00. This fee may not cover postage costs. If you need this service, simply write RUSH on the top of your Registration Form. We will place you in the front of the grading and processing line.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity. Thank you...



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

**TERTIARY TREATMENT TRAINING CEU COURSE  
CUSTOMER SERVICE RESPONSE CARD**

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

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

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

1. Please rate the difficulty of your course.  
Very Easy    0    1    2    3    4    5    Very Difficult
2. Please rate the difficulty of the testing process.  
Very Easy    0    1    2    3    4    5    Very Difficult
3. Please rate the subject matter on the exam to your actual field or work.  
Very Similar    0    1    2    3    4    5    Very Different
4. How did you hear about this Course? \_\_\_\_\_
5. What would you do to improve the Course?

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How about the price of the course?

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

How was your customer service?

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

Any other concerns or comments.

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## Tertiary Treatment Training 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).

Please include your name and address on your Answer Key and make copy for yourself. You can e-mail or fax your Answer Key along with the Registration Form to TLC. **(S) Means answer may be plural or singular. Multiple Choice Section, One answer per question and please use the answer key.**

1. 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 the Federal Water Pollution Control Act, also known as the Clean Water Act?
  - 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

5. Which of the following terms is an industrial user subject to National categorical pretreatment standards?
- A. Blowdown
  - B. Categorical Industrial User (CIU)
  - C. Bypass
  - D. Categorical Pretreatment Standards
  - E. Chain of Custody (COC)
  - F. None of the Above
6. Which of the following terms is a codification of Federal rules published annually by the Office of the Federal Register National Archives and Records Administration?
- A. Code of Federal Regulations (CFR)
  - B. Chronic
  - C. Combined Sewer Overflow (CSO)
  - D. Clean Water Act (CWA)
  - E. None of the Above
7. 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
8. 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
9. Which of the following terms is a schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the U.S?
- 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
10. Which of the following terms is a program administered by a State that meets the criteria established in 40 CFR §403.10 and which has been approved by a Regional Administrator
- A. Approved State Pretreatment Program
  - B. Approved/Authorized State
  - C. Act or "the Act"
  - D. Approval Authority
  - E. None of the Above

11. Which of the following terms is limitations on pollutant discharges to POTWs promulgated by the EPA in accordance with Section 307 of the Clean Water Act?
- B. Categorical Industrial User (CIU)
  - C. Bypass
  - D. Categorical Pretreatment Standards
  - E. Chain of Custody (COC)
  - F. None of the Above
12. 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
13. 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
14. 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
15. Which of the following terms is limit based upon the relative strength of a pollutant in a wastestream, usually expressed in mg/l?
- A. Daily Maximum Limitations
  - B. Continuous Discharge
  - C. Concentration-based Limit
  - D. Control Authority
  - E. Conventional Pollutants
  - F. None of the Above
16. 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

17. 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

**Clean Water Act (Rule) Summary**

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

18. 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

19. 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

20. 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

21. 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

22. 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
  - B. Water quality levels
  - C. Clean water legislation
  - D. EPA
  - E. OSHA
  - F. None of the Above

23. Which of the following terms focused on toxic pollutants?
- A. Clean Water Act or CWA
  - B. EPA
  - C. Congress
  - D. Water quality standard(s)
  - E. The 1977 amendments
  - F. None of the Above

24. The CWA provisions for the delegation by which term of many permitting, administrative, and enforcement aspects of the law to state governments?

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

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

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

26. 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

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

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

28. 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
- 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

### **The Future**

29. 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**

30. 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

31. 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**

32. Bacteria naturally found in water 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

33. 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. Chemical(s)
- D. Organic material
- E. Entrapped air
- F. None of the Above

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

- A. True
- B. False

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

- A. True
- B. False

36. 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

37. 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

38. Masses of microorganisms grow and rapidly metabolized 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**

39. Alum, lime, or iron salts are \_\_\_\_\_ that can be added to wastewater to cause certain pollutants to floc or bunch together. The resulting large, heavier masses can be removed faster through physical processes.

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



40. Polymers are \_\_\_\_\_ that have been developed to further improve the physical separation step in wastewater treatment.

- A. Biosolids
- B. Activated Sludge
- C. Simple Chemicals
- D. Organic materials
- E. Synthetic inert chemicals
- F. None of the Above

41. Which of the following terms are added to improve the settling of excess microbiological growth or biosolids in the later stages of treatment?

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

42. Chemicals can be added to change pollutants into new forms that can be removed by physical processes.

- A. True
- B. False

### **Oil and Grease (Scum)**

43. 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

44. Which of the following terms adds to the scum layer in a septic tank, which in turn requires that the tank be pumped more often?

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

### **Inorganics**

45. Residential and nonresidential sources both contribute inorganic minerals, metals, and compounds to wastewater.

- A. True
- B. False

46. 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

47. Heavy metals in industrial wastewater discharges are difficult to remove by conventional treatment methods.

- A. True
- b. False

48. Which of the following wastewater terms are 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

49. Normally, excessive nutrients in receiving waters cause algae and other plants to grow quickly adding oxygen in the water.

- A. True    B. False

50. 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

51. \_\_\_\_\_ 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

### Solids

52. 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

53. 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

54. Solid materials in wastewater can consist of this term and organisms.

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

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

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

56. 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

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

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

58. \_\_\_\_\_ 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

### Gases

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

- A. True
- B. False

60. 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

### Hydrogen Sulfide and Ammonia

61. Hydrogen sulfide and \_\_\_\_\_ are gases that can be toxic and pose asphyxiation hazards.

- A. Ammonia
- B. Wastewater odors
- C. Air
- D. Oxygen
- E. Less oxygen
- F. None of the Above

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

- A. True
- B. False

### Pollutants, Oxygen-Demanding Substances

63. 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

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

66. Both organic matter and \_\_\_\_\_ are called "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. Domestic sewage and \_\_\_\_\_ all contribute oxygen-demanding substances to wastewater.

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

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

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

### Pathogens

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

- A. True
- B. False

### Nutrients

70. The chief nutrients present in natural water that are essential to living organisms are \_\_\_\_\_.

- 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. 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

73. Phosphorous and nitrogen cannot be substantially removed by conventional \_\_\_\_\_.

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

74. Wastewater normally contains an excess of available nutrients since organisms only require small amounts of nutrients during biological treatment.

- 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. 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

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

77. Some inorganic and synthetic organic chemicals are \_\_\_\_\_ at very low concentrations.

- A. Highly poisonous
- B. Ecology
- C. Nutrient rich
- D. Safe for aquatic life
- E. Non-toxic to humans
- F. None of the Above

### **Thermal**

78. 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

79. 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

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 the bar screens.

- A. True
- B. False

82. 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

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

- A. True
- B. False

84. \_\_\_\_\_ are used in the secondary treatment stage 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 Wastewater Treatment

85. Preliminary treatment includes coarse screening, raw influent pumping, static fine screening, grit removal, and selector tanks.

A. True B. False

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

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

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

- A. Solids
- B. Finer debris
- C. Inorganics
- 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. After the raw influent pumping process, the \_\_\_\_\_ passes into the static fine screening process to remove finer debris not captured by the coarse 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 \_\_\_\_\_ process which consists of two vortex grit separators which 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. The \_\_\_\_\_ removed by the preliminary treatment processes must be collected and disposed of in a landfill or 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 is provided by a basket shaped bar screen. The screen collects larger debris which are then removed and sent to a landfill for disposal.

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 in the wastewater are effectively removed by gravity settling.

A. True B. False

98. 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

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 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. 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

102. 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

103. 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

104. 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

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

105. 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

### **Nutrient Removal Technologies**

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

106. \_\_\_\_\_ 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

107. \_\_\_\_\_ 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

108. \_\_\_\_\_ 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

109. Phosphorus removal is typically 1 to 1.5 percent.

- A. True
- B. False

110. 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



111. 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

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

- A. True
- B. False

113. \_\_\_\_\_ - 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

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

114. 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

115. 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

116. 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

117. 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

118. 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

119. 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

120. 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

### Natural Systems

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

- A. True
- B. False

122. 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

123. 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

124. 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

125. Subsurface flow (SF) wetlands are specifically designed to treat or polish this missing term 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

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

- A. True
- B. False

127. 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

128. Oxygen for this missing term is supplied by the plants growing in the wetland.

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



### **Sustainable Nutrient Recovery**

137. 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

138. \_\_\_\_\_ 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

139. 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

140. 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

### **Secondary Clarification Process**

141. 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

142. 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**

143. 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

144. 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

145. 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**

146. 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

147. \_\_\_\_\_ 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

148. 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

### **Other Important Wastewater Characteristics**

149. 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**

150. Temperatures ranging from 77 to 95 degrees Fahrenheit are probably best for wastewater treatment.

A. True B. False

151. While warm temperatures accelerate biological processes and cool temperatures slow them down, \_\_\_\_\_ 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

152. Hot water is a byproduct of many manufacturing processes, is not a pollutant.

A. True B. False

### **pH**

153. The acidity or alkalinity of wastewater affects both treatment and the environment.

A. True B. False

154. Low pH indicates increasing acidity while a high pH indicates increasing alkalinity.

A. True B. False

155. In order to protect organisms in the biological process, the \_\_\_\_\_ of the wastewater needs to remain between 6 and 9.

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

156. Industrial or commercial discharges containing acids and other substances can alter the \_\_\_\_\_ of the wastewater and inactivate treatment processes.

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

**Total Dissolved Solids**

157. Pure water is tasteless, colorless, and odorless and is often called the universal solvent.

- A. True
- B. False

158. \_\_\_\_\_ is often called the universal solvent because it picks up impurities easily.

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

159. Any minerals, salts, metals, cations or anions dissolved in water are referred to as \_\_\_\_\_.

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

160. Inorganic salts and some small amounts of organic matter that are dissolved in water are referred to as \_\_\_\_\_.

- 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

161. Total dissolved solids in drinking water come from natural sources, sewage, urban run-off, industrial wastewater, and water treatment chemicals.

- A. True
- B. False

162. The TDS test provides only a qualitative measure of the amount of dissolved ions. The test does not provide the nature or ion relationships.

- A. True
- B. False

163. \_\_\_\_\_ has been due to natural environmental features such as: mineral springs, carbonate deposits, salt deposits, and sea water intrusion?

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

164. \_\_\_\_\_ is the concentration of the sum of the cations (positively charged) and anions (negatively charged) ions in the water?

- 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

165. 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**

166. Which of the following terms refers to matter suspended or dissolved in water or wastewater, and 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

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

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

168. Which of the following 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

169. Which of the following 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

170. If high TSS completely blocks the light, bottom dwelling plants will stop producing oxygen and die.

- A. True
- B. False

**Total Suspended Solids (TSS)**

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

- A. True
- B. False

172. \_\_\_\_\_ 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

173. \_\_\_\_\_ 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

174. 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

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

176. The eggs of fish and aquatic insects can be smothered when suspended solids settle to the bottom of a water body.

A. True B. False

177. Which of the following terms can damage the aquatic habitat by filling in spaces between rocks that could have been homes to aquatic organisms?

A. Oxygen D. Hydrogen sulfide  
B. Organic material E. Suspended sediments  
C. Settling sediments F. None of the Above

178. If high TSS completely blocks the light, bottom dwelling plants will stop producing oxygen and die.

A. True B. False

179. Estimating this term 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) D. This can increase flow(s)  
B. Flow volume(s) E. Original design load  
C. Additional flows F. None of the Above

180. High TSS can often mean higher concentrations of pollutants such as bacteria, nutrients, pesticides, and metals in the water.

A. True B. False

### **Application Specific Microbiology**

181. \_\_\_\_\_ is the preferred methodology in wastewater treatment affecting the efficiency of biological nutrient removal?

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

182. Application-specific microbiology involves using the right laboratory prepared bugs in the right growth environment to maximize the efficiency of organics removal.

A. True B. False



183. To reduce the start-up phase for growing a mature biofilm one can also purchase this term 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

184. 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

185. 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

186. 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

### Nitrogen Control

187. Nitrogen in wastewater is usually not removed by secondary treatment.

- A. True
- B. False

188. Ammonia in wastewater is not toxic to aquatic life.

- A. True
- B. False

189. 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

190. A biological treatment process beyond the secondary stage uses nitrifying bacteria to convert ammonia to non-toxic nitrate. This process is called \_\_\_\_\_.

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

191. To remove nitrate from wastewater effluent, another \_\_\_\_\_ process can be added to convert nitrate to nitrogen gas.

- A. Nitrification
- B. Chemical
- C. Physical
- D. Primary
- E. Biological
- F. None of the Above

### Conversion of Nitrate to Nitrogen Gas

192. Nitrate can be converted to \_\_\_\_\_ by bacteria in a process known as denitrification.

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

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

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

194. Which of the following terms comprises almost 80 percent of the air in the earth's atmosphere?

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

### Biological Phosphorus Control

195. Phosphorous needs to be removed from wastewater effluent to prevent excessive algal growth in the receiving waters.

- A. True    B. False

196. One way to remove \_\_\_\_\_ is the addition of chemicals and a coagulation-sedimentation process.

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

197. Biological nutrient removal (BNR) processes can remove \_\_\_\_\_.

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

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

### Coagulation-Sedimentation Process

199. 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

200. \_\_\_\_\_ is used to increase the removal of solids from effluent after primary and secondary treatment?

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

201. \_\_\_\_\_ added to the wastewater to remove phosphorus?
- A. Other alkaline materials      D. Alum, lime, or iron salts are chemicals  
 B. A form of stabilization      E. Phosphate  
 C. Sewage solids, or sludge      F. None of the Above
202. \_\_\_\_\_ is considered an advanced process because it is not routinely applied to the treatment of municipal wastewater?
- A. Carbon adsorption      D. A form of stabilization  
 B. An advanced process      E. Processed wastewater solids ("sewage sludge")  
 C. Coagulation-sedimentation      F. None of the Above

### Carbon Adsorption

203. Carbon adsorption technology can remove organic materials from wastewater that resist removal by?
- A. Denitrification process      D. Insufficient aeration in the reactor  
 B. Biological treatment      E. Anaerobic sludge  
 C. Bulking sludge      F. None of the Above
204. \_\_\_\_\_ consists of passing the wastewater effluent through of activated carbon granules or powder?
- A. Carbon adsorption      D. A form of stabilization  
 B. An advanced process      E. Super treatment  
 C. Carbonic dioxide      F. None of the Above

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

205. When pollutants are removed from water, there may be the \_\_\_\_\_ that settle to the bottom of sedimentation tanks.
- A. Other alkaline materials      D. Biosolids  
 B. Solids      E. Rags and sticks  
 C. Sewage solids, or sludge      F. None of the Above
206. 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

207. \_\_\_\_\_ 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

208. 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

209. Which of the following terms when separated from the wastewater, contain around 98 percent water?

- A. Biosolids
- B. An advanced process
- C. Sewage solids, or sludge
- D. Other alkaline materials
- E. Processed wastewater solids ("sewage sludge")
- F. None of the Above

### Dewatering Processes

210. To improve dewatering effectiveness, the solids can be pretreated with chemicals such as lime, ferric chloride, or polymers to produce larger particles which are easier to remove.

- A. True
- B. False

211. Which of the following terms include drying beds, belt filter presses, plate and frame presses, and centrifuges?

- A. Dewatering processes
- B. A form of stabilization
- C. Sewage solids, or sludge
- D. Stabilization of solids
- E. Digestion
- F. None of the Above

### Digestion

212. Digestion is a form of \_\_\_\_\_ where the volatile material can decompose naturally and the potential for odor production is reduced.

- A. Dewatering processes
- B. Release
- C. Sewage solids, or sludge
- D. Stabilization of solids
- E. Stabilization
- F. None of the Above

213. Which of the following terms in an enclosed tank has the added benefit of producing methane gas which can be recovered and used as a source of energy?

- A. Dewatering processes
- B. Digestion without air
- C. Sewage solids, or sludge
- D. Stabilization of solids
- E. Digestion
- F. None of the Above

214. Which of the following 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

215. 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

216. When developing water quality criteria, EPA examines the effects of specific pollutants on aquatic life, plant life, aesthetics, and recreation in any body of water.

- A. True
- B. False

### Human Health Criteria

217. 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**

218. 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

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

- A. True B. False

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

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

### **Sediment Quality Criteria Guidance**

221. In a healthy aquatic community, \_\_\_\_\_ provide a habitat for worms, plants, and tiny microorganisms.

- A. Pollutants D. Aquatic plants  
B. Algae E. Human health and aquatic life criteria  
C. Sediments F. None of the Above

### **Pollutants in the Sediment**

222. Bottom dwelling species can be protected by controlling the \_\_\_\_\_ in the sediment. This prevents harmful toxins from accumulating in animals at higher levels in the food chain.

- A. Nitrogen level D. Concentration of pollutants  
B. Phosphorous level E. Bacteria  
C. Oxygen level F. None of the Above

223. \_\_\_\_\_ in the sediment that does not harm snails or small fish may bioaccumulate in the food chain?

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

224. \_\_\_\_\_: The EPA develops \_\_\_\_\_ on the concentrations or amounts of individual chemicals that can be present in river, lake, or stream sediments

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

### **Biological Criteria**

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

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

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

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

227. 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

228. 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

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

- A. True
- B. False

230. 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

231. 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

232. 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

233. 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

234. The organic load present is incorporated in part as represented by which term 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 microorganisms
- F. None of the Above

235. 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

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

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

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

### **Aerobic Processes**

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

A. True B. False

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

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

240. \_\_\_\_\_ are usually designed from pilot plant and laboratory studies?

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

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

### **Microorganisms in Lagoons**

242. 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

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

244. The omnivores, such as most of these bugs, eat whatever is readily available, while these (Missing term) feed on the floc or prey on larger organisms. Microorganisms are directly affected by their treatment environment.

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

245. 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

246. 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 - Microorganisms in Lagoons and Activated Sludge**

247. 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

248. All groups of aerobic bacteria oxidize organic carbon (BOD) to produce CO<sub>2</sub> and new bacteria.

- A. True
- B. False

249. \_\_\_\_\_ readily oxidize BOD, but they do not settle and often leave the system in the effluent as solids (TSS).

- A. Strict aerobes
- B. Predators
- C. Single bacteria
- D. Heterotrophic bacteria
- E. Filamentous bacteria
- F. None of the Above

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

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

251. 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

252. \_\_\_\_\_ 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



253. 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

254. 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

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

- A. True
- B. False

256. 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**

257. 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

258. 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

259. 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

260. Lagoons are exposed to low temperatures that 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

261. 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

262. \_\_\_\_\_ 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

263. \_\_\_\_\_ 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

264. 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**

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

- A. True
- B. False

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

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

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

- A. True
- B. False

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

- A. True
- B. False

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

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

### **Anaerobic Bacteria**

270. \_\_\_\_\_ commonly occur in lagoons are involved in methane formation and in sulfate reduction?

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

271. 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

272. \_\_\_\_\_ 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

273. \_\_\_\_\_ 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

274. \_\_\_\_\_ 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

275. 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

276. \_\_\_\_\_ 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

277. \_\_\_\_\_ 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

278. \_\_\_\_\_ and 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

279. \_\_\_\_\_ 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

280. 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

### Treatment Lagoon

281. \_\_\_\_\_ at a treatment lagoon is determined by the various chemical species of alkalinity that are present?

- A. Bicarbonate ion ( $\text{HCO}_3$ )
- B.  $\text{CO}_2$
- C. Carbonate ion ( $\text{CO}_2^3$ )
- D. pH
- E. Phosphorus
- F. None of the Above

282. High amounts of \_\_\_\_\_ yield a low lagoon pH, while high amounts of  $\text{CO}_2^3$  yield a high lagoon pH.

- A. Alkalinity and pH
- B.  $\text{CO}_2$
- C. BOD
- D. Algal growth
- E. Phosphorus
- F. None of the Above

283. Bacterial growth on BOD releases  $\text{CO}_2$  which subsequently dissolves in water to yield?

- A. Bicarbonate ion ( $\text{HCO}_3$ )
- B.  $\text{CO}_2$
- C. Carbonate ion ( $\text{CO}_2^3$ )
- D. Carbonic acid ( $\text{H}_2\text{CO}_3$ )
- E. Phosphorus
- F. None of the Above

284. According to the text, algal growth in lagoons has the opposite effect on lagoon \_\_\_\_\_, raising the pH due to algal use for growth of inorganic carbon ( $\text{CO}_2$  and  $\text{HCO}_3$ ).

- A. Alkalinity and pH
- B.  $\text{CO}_2$
- C. BOD
- D. pH
- E. Phosphorus
- F. None of the Above

285. Algal growth reduces the lagoon alkalinity that may cause the \_\_\_\_\_ to increase if the lagoon alkalinity is low.

- A. Bicarbonate ion ( $\text{HCO}_3$ )
- B.  $\text{CO}_2$
- C. Carbonate ion ( $\text{CO}_2^3$ )
- D. pH
- E. Phosphorus
- F. None of the Above

286. Algae can grow to such an extent in lagoons that they consume?

- A. Alkalinity and pH
- B.  $\text{CO}_2$
- C. BOD
- D. All of the  $\text{CO}_2$  and  $\text{HCO}_3$
- E. Phosphorus
- F. None of the Above

287. pH caused by \_\_\_\_\_ can be beneficial.

- A. Bicarbonate ion ( $\text{HCO}_3$ )
- B.  $\text{CO}_2$
- C. Carbonate ion ( $\text{CO}_2^3$ )
- D. Algal growth
- E. Phosphorus
- F. None of the Above

288. Which of the following related terms, removal by natural chemical precipitation is greatly enhanced at pH values greater than pH = 8.5?

- A. Alkalinity and pH
- B. CO<sub>2</sub>
- C. BOD
- D. Algal growth
- E. Phosphorus
- F. None of the Above

### Protozoans and Microinvertebrates

289. 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

290. \_\_\_\_\_ 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

291. \_\_\_\_\_ 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

292. \_\_\_\_\_ 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

293. 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

294. 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

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

- A. True
- B. False

296. The flocculating characteristics of the cells improve the longer they are retained in the system, since they start to produce extra cellular slime which favors \_\_\_\_\_.

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

### Common Types

297. 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

298. In the conventional activated sludge process, the organic load concentration and the oxygen demand are both maximum at the inlet to the aeration tank.

- A. True
- B. False

### Bugs or MOs Section - Paramecium sp.

299. 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

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

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

301. 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

302. \_\_\_\_\_ swim freely in the water column and filter suspended bacteria from the water.

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

### Vorticella sp.

303. Vorticella is a \_\_\_\_\_ found in activated sludge that ranges in length from 30 to 150  $\mu\text{m}$ .

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

304. After reproducing, the offspring of a Vorticella develops swimming cilia and forms its own stalk.

- A. True
- B. False

305. Which of the following bugs are present when the plant effluent quality is high?

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

306. 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

**Euglypha sp.**

307. Euglypha are \_\_\_\_\_ with jelly-like bodies and range in size from 70 to 100  $\mu\text{m}$ .  
 A. Shelled amoeba(s)    D. Stalked ciliate  
 B. Water bear            E. Paramecium  
 C. Vorticella             F. None of the Above

308. Euglypha move and feed on bacteria by extending the pseudopodia outward in long, thin, rays.  
 A. True                    B. False

309. Since Euglypha adapt to a wide range of conditions, they are good indicator organisms.  
 A. True                    B. False

310. Which of the following bugs is a shelled (testate) amoeba?  
 A. Shelled amoeba(s)    D. Stalked ciliate  
 B. Euglypha                E. Paramecium  
 C. Vorticella              F. None of the Above

311. 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.**

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

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

314. The presence of Euchlanis in \_\_\_\_\_ is evidence that aerobic conditions have been sustained, and that effluent quality is good.  
 A. Biofilm                 D. Activated sludge  
 B. Plant effluent         E. Wastewater  
 C. Some bacteria         F. None of the Above

### Bacteria Section

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

- A. True B. False

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

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

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

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

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

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

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

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

320. \_\_\_\_\_ secrete sticky substances that form the gel in which they live.

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

### Filamentous Bacteria

321. \_\_\_\_\_ are a type of bacteria that can be found in a wastewater treatment system?

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

322. Filamentous bacteria found in wastewater function similar to \_\_\_\_\_.

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

323. 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

### Site Specific Bacteria

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

- A. True B. False



325. Which of the following terms become site-specific over time as the biofilm develops and matures?

- 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

326. 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

327. Facultative bacteria will be \_\_\_\_\_ unless oxygen is added to the water.

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

328. When oxygen is added to the environment of facultative bacteria, the metamorphosis from \_\_\_\_\_ takes place within a couple of hours.

- A. Filamentous bacteria
- B. Facultative bacteria
- C. Application-specific bacteria
- D. Site-specific bacteria
- E. Anaerobic to aerobic state
- F. None of the Above

### Anaerobic Bacteria

329. \_\_\_\_\_ 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

330. 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

331. 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

332. \_\_\_\_\_ 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

333. Because of \_\_\_\_\_, hydrogen sulfide or explosive methane gas can accumulate in the collection system and be life-threatening.

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

### **Aerobic Bacteria**

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

- A. True
- B. False

335. Facultative bacteria always achieve an aerobic state when oxygen is present.

- A. True
- B. False

336. 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
- B. Anaerobes
- C. Facultative bacteria
- D. Aerobic bacteria
- E. Application-specific bacteria
- F. None of the Above

337. 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

338. \_\_\_\_\_ 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

339. 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**

340. 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

341. \_\_\_\_\_ or bugs are also indicators of biomass health and effluent quality?

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

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

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

343. \_\_\_\_\_ or bugs are typically found only in a well-developed biomass?

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

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

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

### **Dispersed Growth**

345. 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

346. 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**

347. 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

348. 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:**

349. 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

350. 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

### **Filamentous Organisms**

351. 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

352. 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

353. Which of the following wastewater treatment related terms, due to the high surface area of this term will reach an excess concentration?

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Process control variation
- E. Filamentous bacteria
- F. None of the Above

354. The majority of filamentous organisms are bacteria, although some of them are classified as algae, fungi or other life forms. There are a number of types of filamentous bacteria which proliferate in the Activated sludge process.

- A. True
- B. False

355. Filamentous organisms serve to strengthen the?

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

356. Which of the following wastewater treatment related terms that settling in the clarifier also tends to accumulate smaller particulates?

- A. Larger floc particles
- B. Activated sludge process
- C. Floating scum mat
- D. Biomass
- E. Filaments
- F. None of the Above

### **Filamentous Bacteria Identification**

357. 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

358. Filamentous Identification is used to determine the type of filaments present so that a cause can be found and corrections can be made to the system to alleviate future problems.

- A. True
- B. False

359. Which of the following wastewater treatment related terms usually have a process control variation associated with the type of filament present that can be implemented to change the environment present?

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

360. Which of the following wastewater treatment related terms change must be made or the filaments will return with time eventually?

- A. Larger floc particles
- B. Activated sludge process
- C. Floating scum mat
- D. Biomass
- E. A process
- F. None of the Above

### **Nocardia amarae**

361. *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

362. Colonies can be \_\_\_\_\_, so color alone is not a key to identifying this species.

- A. Stain gram-negative
- B. Not casease
- C. Slower growing filaments
- D. Disruptive foaming
- E. Brown, pink, orange, red, purple, gray or white
- F. None of the Above

363. *N. amarae*, member of the Actinomycetes family, is very motile, so it doesn't rely on movement of the water to carry it through the system.

- A. True
- B. False

364. 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
- B. Staining gram-positive
- C. Mixotrophic
- D. Gram-positive, chemoautotrophic, filamentous
- E. Disruptive foaming
- F. None of the Above

### **Nostocoida limicola**

365. *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

### **Thiothrix**

366. *Thiothrix* spp., the primary cause of disruptive foaming in wastewater treatment plants appears as straight to slightly curved cells with rectangular shape form filaments up to 1000 microns in length, in multicellular rigid filaments Staining gram-positive, with obligately aerobic respiration.

- A. True
- B. False

367. Thiolithrix are considered this missing term, using several small organic carbons and reduced inorganic sulfur sources for growth and energy.

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

#### **Microthrix parvicella**

368. Microthrix parvicella is another common cause of?

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

#### **Sphaeroliticus natans**

369. 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

370. Cells are straight to slightly curved, up to 1000 microns in length and?

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

#### **Filamentous Bacteria**

371. A problem that often frustrates the performance of activated sludge is bulking sludge due to the growth of filamentous bacteria. Sludge bulking can often be solved by careful process modifications.

- A. True
- B. False

372. Different filamentous bacteria such as Microthrix, Sphaerotilus, Nostocoida, Thiolithrix or "Type 021N" and others cause?

- A. Bulking for very different reasons
- B. Dissolved oxygen decrease
- C. Sludge bulking
- D. Bacteria and other microbes
- E. Oxygen-demanding pollutants
- F. None of the Above

373. There is a potential for instability with \_\_\_\_\_ is an acute problem when strict demands on treatment performance are in place.

- A. Organic carbon
- B. Activated sludge
- C. Domestic wastewater
- D. High BOD
- E. Growth of filamentous bacteria
- F. None of the Above

#### **Other Wastewater Treatment Components**

##### **Biochemical Oxygen Demand**

374. Biochemical Oxygen Demand (BOD or BOD<sub>5</sub>) is an indirect measure of Biodegradable organic compounds in water, and is determined by measuring the dissolved oxygen decrease in a controlled water sample over a five-day period.

- A. True
- B. False

375. During this five-day period, aerobic (oxygen-consuming) bacteria decompose organic matter in the sample and consume dissolved oxygen in proportion to the amount of organic material that is present.

- A. True
- B. False

376. \_\_\_\_\_ reflects high concentrations of substances that can be biologically degraded, thereby consuming oxygen?

- A. Organic carbon
- B. Human sources
- C. Domestic wastewater
- D. High BOD
- E. Growth of filamentous bacteria
- F. None of the Above

377. The BOD test has merit as a pollution parameter continues to be debated, \_\_\_\_\_ has the advantage of a long period of record.

- A. BOD
- B. Dissolved oxygen decrease
- C. Sludge bulking
- D. Bacteria and other microbes
- E. Oxygen-demanding pollutants
- F. None of the Above

### Organic Carbon

378. Most organic carbon in water occurs as partly degraded plant and animal materials, some of which are resistant to microbial degradation.

- A. True
- B. False

379. Dead tissue containing carbon is decomposed as \_\_\_\_\_ by bacteria and other microbes.

- A. An essential nutrient
- B. Dissolved oxygen decrease
- C. Sludge bulking
- D. Detritus
- E. Oxygen-demanding pollutants
- F. None of the Above

### Total Organic Carbon

380. TOC bears a direct relationship with biological and chemical oxygen demand; high levels of TOC can result from human sources, this term being the main concern.

- A. Organic carbon
- B. High oxygen demand
- C. Domestic wastewater
- D. High BOD
- E. Growth of filamentous bacteria
- F. None of the Above

### Nutrient Constituents in Wastewater and Measurement Methods

#### Nitrogen

381. The major contributors of nitrogen to wastewater are \_\_\_\_\_ such as food preparation, showering, and waste excretion.

- A. Human activities
- B. Dissolved oxygen decrease
- C. Sludge bulking
- D. Bacteria and other microbes
- E. Oxygen-demanding pollutants
- F. None of the Above

382. The per capita contribution of nitrogen in domestic wastewater is about 1/10th of that for BOD.

- A. True
- B. False

383. \_\_\_\_\_ in domestic wastewater typically ranges from 20 to 70 mg/L for low to high strength wastewater?

- A. Organic carbon
- B. Total nitrogen
- C. Domestic wastewater
- D. High BOD
- E. Growth of filamentous bacteria
- F. None of the Above

384. Influent concentration varies during the day and can vary significantly during rainfall events, as a result of?

- A. An essential nutrient
- B. Dissolved oxygen decrease
- C. Sludge bulking
- D. Inflow and infiltration to the collection system
- E. Oxygen-demanding pollutants
- F. None of the Above

**The TKN method has three major steps:**

385. Digestion to convert organic nitrogen to?

- A. TKN
- B. Organic nitrogen
- C. Aliphatic N compounds
- D. Ammonium sulfate
- E. Dissolved, biodegradable compounds
- F. None of the Above

386. Conversion of \_\_\_\_\_ into condensed ammonia gas through addition of a strong base and boiling.

- A. Ammonia gas
- B. Effluent limits
- C. DON
- D. Ammonium sulfate
- E. Domestic wastewater organic nitrogen
- F. None of the Above

387. Measuring the concentration includes ammonia, with \_\_\_\_\_ being subtracted from the TKN to determine organic nitrogen.

- A. TKN
- B. Organic nitrogen
- C. Aliphatic N compounds
- D. Ammonium sulfate
- E. Ammonia-nitrogen concentration
- F. None of the Above

388. Nitrogen components in wastewater are typically reported on an “\_\_\_\_\_” basis?

- A. Ammonia gas
- B. Effluent limits
- C. DON
- D. As nitrogen
- E. Domestic wastewater organic nitrogen
- F. None of the Above

389. Wastewater treatment plants are designed for nitrification and denitrification and these can remove 80 to 95 percent of \_\_\_\_\_, but the removal of organic nitrogen is typically much less efficient.

- A. TKN
- B. Organic nitrogen
- C. Aliphatic N compounds
- D. Ammonium sulfate
- E. Inorganic nitrogen
- F. None of the Above

390. According to the text, domestic wastewater organic nitrogen may be present in particulate, colloidal or dissolved forms and consist of proteins, amino acids, \_\_\_\_\_, refractory natural compounds in drinking water.

- A. Ammonia gas
- B. Effluent limits
- C. DON
- D. Aliphatic N compounds
- E. Domestic wastewater organic nitrogen
- F. None of the Above

391. \_\_\_\_\_ may be released in secondary treatment by microorganisms either through metabolism or upon death and lysis.

- A. TKN
- B. Organic nitrogen
- C. Aliphatic N compounds
- D. Ammonium sulfate
- E. Dissolved, biodegradable compounds
- F. None of the Above



392. \_\_\_\_\_ happens by microorganisms releases some organic nitrogen as dissolved, biodegradable compounds?

- A. Ammonia gas
- B. Effluent limits
- C. DON
- D. Hydrolysis of particulate and colloidal material
- E. Domestic wastewater organic nitrogen
- F. None of the Above

393. Other forms of \_\_\_\_\_ may be more persistent in wastewater treatment processes.

- A. TKN
- B. Organic nitrogen
- C. Aliphatic N compounds
- D. Ammonium sulfate
- E. Dissolved, biodegradable compounds
- F. None of the Above

394. The chemical composition of DON in wastewater effluents is completely understood.

- A. True
- B. False

### Phosphorus

395. \_\_\_\_\_ in domestic wastewater typically ranges between 4 and 8 mg/L but can be higher depending on sources?

- A. Phosphorus as phosphate
- B. Phosphorus
- C. Orthophosphate
- D. Pyrophosphate and trimetaphosphate
- E. Total phosphorus (TP)
- F. None of the Above

### Activated Sludge Process

396. When free or dissolved oxygen is present in the aquatic environment, the condition is called aerobic.

- A. True
- B. False

397. Aerobic bacteria require an environment containing oxygen to live and reproduce.

- A. True
- B. False

398. Aerobes can use chemically combined oxygen, such as in water molecules, for respiration.

- A. True
- B. False

399. When free or dissolved oxygen is not present in the aquatic environment, the condition is called anaerobic.

- A. True
- B. False

400. The volatile acids are broken down by bacteria known as methane fermenters to form methane, carbon dioxide, and water.

- A. True
- B. False