

Registration form

NUTRIENT REMOVAL TRAINING COURSE \$100.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00

Start and finish dates: _____
You will have 90 days from this date in order to complete this course

Name _____ **Signature** _____
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Collection ___ Wastewater Treatment ___ Pretreatment ___ Other _____

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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.

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Nutrient Removal Answer Key

Name _____

Phone # _____

Did you check with your State agency to ensure this course is accepted for credit? No refunds.

Method of Course acceptance confirmation. Please fill this section

Website ___ Telephone Call ___ Email ___ Spoke to _____

Did you receive the approval number, if applicable? _____

What is the course approval number, if applicable? _____

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

You can also fill this assignment out electronically in Adobe Acrobat DC

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

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| 1. A B C D | 15. A B C D | 29. A B C D | 43. A B |
| 2. A B C D | 16. A B C D | 30. A B C D | 44. A B |
| 3. A B C D | 17. A B C D | 31. A B | 45. A B C D |
| 4. A B | 18. A B C D | 32. A B C D | 46. A B C D |
| 5. A B C D | 19. A B C D | 33. A B C D | 47. A B C D |
| 6. A B C D | 20. A B C D | 34. A B C D | 48. A B C D |
| 7. A B C D | 21. A B C D | 35. A B C D | 49. A B |
| 8. A B C D | 22. A B C D | 36. A B | 50. A B C D |
| 9. A B | 23. A B C D | 37. A B | 51. A B |
| 10. A B C D | 24. A B | 38. A B C D | 52. A B |
| 11. A B C D | 25. A B C D | 39. A B C D | 53. A B |
| 12. A B C D | 26. A B | 40. A B C D | 54. A B C D |
| 13. A B | 27. A B C D | 41. A B C D | 55. A B C D |
| 14. A B | 28. A B C D | 42. A B | 56. A B C D |

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| 57. A B C D | 89. A B C D | 121. A B C D | 153. A B |
| 58. A B C D | 90. A B C D | 122. A B C D | 154. A B C D |
| 59. A B | 91. A B | 123. A B C D | 155. A B C D |
| 60. A B | 92. A B C D | 124. A B C D | 156. A B |
| 61. A B C D | 93. A B C D | 125. A B | 157. A B C D |
| 62. A B C D | 94. A B C D | 126. A B C D | 158. A B C D |
| 63. A B | 95. A B C D | 127. A B C D | 159. A B C D |
| 64. A B C D | 96. A B C D | 128. A B C D | 160. A B |
| 65. A B C D | 97. A B C D | 129. A B C D | 161. A B C |
| 66. A B C D | 98. A B C D | 130. A B C D | 162. A B C D |
| 67. A B C D | 99. A B C D | 131. A B C D | 163. A B C D |
| 68. A B C D | 100. A B | 132. A B | 164. A B C D |
| 69. A B C D | 101. A B C D | 133. A B C D | 165. A B C D |
| 70. A B C D | 102. A B C D | 134. A B | 166. A B C D |
| 71. A B C D | 103. A B | 135. A B C D | 167. A B C D |
| 72. A B C D | 104. A B | 136. A B C D | 168. A B C D |
| 73. A B | 105. A B | 137. A B C D | 169. A B |
| 74. A B | 106. A B C D | 138. A B C D | 170. A B |
| 75. A B C D | 107. A B C D | 139. A B | 171. A B C D |
| 76. A B C D | 108. A B C D | 140. A B C D | 172. A B C D |
| 77. A B C D | 109. A B C D | 141. A B C D | 173. A B C D |
| 78. A B C D | 110. A B C D | 142. A B C D | 174. A B C D |
| 79. A B C D | 111. A B C D | 143. A B C D | 175. A B C D |
| 80. A B | 112. A B | 144. A B | 176. A B C D |
| 81. A B C D | 113. A B | 145. A B C D | 177. A B C D |
| 82. A B C D | 114. A B | 146. A B C D | 178. A B C D |
| 83. A B C D | 115. A B C D | 147. A B | 179. A B C D |
| 84. A B C D | 116. A B C D | 148. A B C D | 180. A B C D |
| 85. A B C D | 117. A B C D | 149. A B C D | 181. A B |
| 86. A B C D | 118. A B C D | 150. A B C D | 182. A B |
| 87. A B | 119. A B C D | 151. A B | 183. A B |
| 88. A B C D | 120. A B C D | 152. A B | 184. A B C D |

185. A B C D	202. A B C D	219. A B C D	236. A B C D
186. A B C D	203. A B C D	220. A B	237. A B C D
187. A B C D	204. A B C D	221. A B C D	238. A B
188. A B C D	205. A B C D	222. A B	239. A B
189. A B C D	206. A B C D	223. A B C D	240. A B
190. A B C D	207. A B C D	224. A B C D	241. A B C D
191. A B C D	208. A B	225. A B	242. A B C D
192. A B	209. A B	226. A B	243. A B
193. A B C D	210. A B	227. A B C D	244. A B
194. A B C D	211. A B C D	228. A B C D	245. A B
195. A B C D	212. A B C D	229. A B C D	246. A B
196. A B	213. A B	230. A B	247. A B
197. A B	214. A B C D	231. A B	248. A B C D
198. A B	215. A B C D	232. A B C D	249. A B
199. A B C D	216. A B	233. A B C D	250. A B C D
200. A B C D	217. A B C D	234. A B C D	
201. A B	218. A B C D	235. A B C D	

I understand that I am 100 percent responsible to ensure that TLC receives the Assignment and Registration Key and that it is accepted for credit by my State or Providence. I understand that TLC has a zero tolerance towards not following their rules, cheating or hostility towards staff or instructors. I need to complete the entire assignment for credit. There is no credit for partial assignment completion. My exam was proctored. I will contact TLC if I do not hear back from them within 2 days of assignment submission. I will forfeit my purchase costs and will not receive credit or a refund if I do not abide with TLC's rules.

Please Sign that you understand and will abide with TLC's Rules.

Signature

Please write down any questions you were not able to find the answers or that have errors.

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

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

**NUTRIENT REMOVAL CEU COURSE
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1. Please rate the difficulty of your course.
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2. Please rate the difficulty of the testing process.
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4. How did you hear about this Course? _____

5. What would you do to improve the Course?

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Any other concerns or comments.

Nutrient Removal Training Course Assignment

Your assignment is to correctly answer the following questions about the characteristic of the wastewater treatment system, rules and regulations, bugs and the activated sludge process.

You will have 90 days in order to successfully complete this assignment with a score of 70% or better. If you need any assistance, please contact TLC's Student Services. Once you are finished, please, e-mail or fax or e-mail your answer sheet along with your registration form.

Please use the Answer Key and Registration form. Select only one answer per question.

Nutrients

1. Which of the following have also been linked to ocean "red tides" that poison fish and cause illness in humans?
A. Nutrients from wastewater
B. Inorganic minerals
C. Excessive grease
D. None of the above
2. Which of the following in drinking water may contribute to miscarriages and is the cause of a serious illness in infants called methemoglobinemia or "blue baby syndrome?"
A. Most inorganic substances
B. Phosphorus
C. Nitrogen
D. None of the above
3. According to the text, wastewater often contains large amounts of which term in the form of nitrate and phosphate, which promote plant growth?
A. Nutrients from wastewater
B. Inorganic minerals
C. Nutrients nitrogen and phosphorus
D. None of the above
4. Normally, excessive nutrients in receiving waters cause algae and other plants to grow quickly adding oxygen in the water, because of this additional of oxygen, fish and other aquatic life thrive.
A. True
B. False
5. Organisms only require small amounts of _____ in biological treatment, so there normally is an excess available in treated wastewater.
A. BOD
B. Nutrients
C. Microorganisms
D. None of the above

Solids

6. Which of the following must be treated, or they will clog soil absorption systems or reduce the effectiveness of disinfection systems?
A. Organic material
B. The solids
C. Suspended solids in wastewater
D. None of the above
7. Which of the following represents small particles of certain wastewater materials can dissolve, like salt in water?
A. Organic material
B. The solids
C. Dissolved solids
D. None of the above

8. Solid materials in wastewater can consist of which term and organisms?
 A. Organic material C. Organic and/or inorganic materials
 B. The solids D. None of the above
9. 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
10. On the bottom of settling tanks and ponds, _____ makes up a biologically active layer of sludge that aids in treatment.
 A. BOD C. Heavier organic and inorganic materials
 B. Organic material D. None of the above
11. Which of the following represents materials that resist settling may remain suspended in wastewater?
 A. Suspended solids C. Microorganisms
 B. Organic material D. None of the above
12. Some dissolved materials are consumed by _____ in wastewater.
 A. BOD C. Microorganisms
 B. Organic material D. None of the above
13. Excessive amounts of dissolved solids in wastewater can have adverse effects on the environment.
 A. True B. False

Gases

14. Certain gases in wastewater can cause odors, affect treatment, or are potentially dangerous.
 A. True B. False
15. Methane gas, is a byproduct of which wastewater term and is highly combustible?
 A. Dissolved oxygen C. Anaerobic biological treatment
 B. Magnesium hydroxide D. None of the above

Hydrogen Sulfide and Ammonia

16. The gases hydrogen sulfide and along with which substance can be toxic and pose asphyxiation hazards?
 A. Ammonia C. The lack of oxygen
 B. Wastewater odor(s) D. None of the above
17. Which of the following will create conditions in the sewer system because of the lack of oxygen?
 A. Wastewater odor(s) C. Less oxygen
 B. Hydrogen sulfide D. None of the above
18. Unless effectively contained or minimized by design and location, wastewater odors can affect the mental well-being and?
 A. Dissolved oxygen C. Biochemical oxygen demand, or BOD
 B. Quality of life of residents D. None of the above

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

- A. Wastewater odor(s)
- B. Hydrogen sulfide or H₂S problem(s)
- C. Domestic sewage
- D. None of the above

30. Oxygen-demanding substances are usually destroyed or converted to other compounds by which term if there is sufficient oxygen present in the water?

- A. Dissolved oxygen
- B. Bacteria
- C. Biochemical oxygen demand, or BOD
- D. None of the above

Pathogens

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

- A. True
- B. False

Nutrients

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

- A. Oxygen
- B. Phosphorus and nitrogen
- C. Carbon, nitrogen, and phosphorus
- D. None of the above

33. Uncontrolled algae growth blocks out sunlight and chokes aquatic plants and animals by depleting _____ in the water at night.

- A. Dissolved oxygen
- B. Nutrients
- C. Phosphorus and nitrogen
- D. None of the above

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

- A. Nutrient enrichment
- B. Oxygen and organic waste
- C. Eutrophication or cultural enrichment
- D. None of the above

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

- A. Chemical
- B. Advanced
- C. Conventional secondary biological treatment processes
- D. None of the above

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

- A. True
- B. False

37. 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

38. Primarily _____ but occasionally nitrogen, causes nutrient enrichment which results in excessive growth of algae.

- A. Phosphorus
- B. Heavy metals
- C. Algae
- D. None of the above

Inorganic and Synthetic Organic Chemicals

39. Inorganic and Synthetic Organic Chemicals can cause _____ problems, and many are not effectively removed by conventional wastewater treatment.

- A. Excessive growth of algae
- B. Nutrient enrichment
- C. Taste and odor
- D. None of the above

Thermal

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

- A. Heat
- B. Nutrient enrichment
- C. Algae
- D. None of the above

41. Unchecked discharges of which term can seriously alter the ecology of a lake, a stream, or estuary?

- A. DO
- B. Waste heat
- C. Dechlorinated water
- D. None of the above

42. 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

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

- A. True
- B. False

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

- A. True
- B. False

45. Coarse solids are removed from the wastewater in the primary stage of treatment. In some treatment plants, _____ may be combined into one basic operation.

- A. Grit and gravel
- B. Primary and secondary stages
- C. Suspended growth process(es)
- D. None of the above

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

- A. Biological processes
- B. Primary sludge
- C. Grit and screenings
- D. None of the above

Preliminary Treatment

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

- A. Very fine solids
- B. Grit and gravel
- C. Primary sludge
- D. None of the above

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

- A. Solid(s)
- B. Grit and sand
- C. Dissolved organic and inorganic constituents
- D. None of the above

49. 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

50. The _____ enters from the collection system into the Coarse Screening process.
 A. Raw wastewater C. Dissolved organic and inorganic constituents
 B. Grit and gravel D. None of the above
51. The Preliminary Treatment is purely physical stage consisting of Coarse Screening, Raw Influent Pumping, Static Fine Screening, Grit Removal, and Selector Tanks.
 A. True B. False
52. 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
53. The Coarse Screening consists of a basket shaped bar screen which collects larger debris (several inches in diameter) prior to the Raw Influent Pumping.
 A. True B. False
54. Which of the following passes into the Static Fine Screening process which consists of two stationary (or static) screens?
 A. Solid(s) C. Flow
 B. Grit and gravel D. None of the above
55. The wastewater passes into the _____ process which consists of two vortex grit separators which produce a whirlpool action to force the finest debris to the outside perimeter.
 A. Box C. Primary rake
 B. Grit Removal D. None of the above
56. Which of the following are removed by these processes must be periodically collected and trucked to a landfill for disposal or are incinerated?
 A. Wastewater C. Grit and screenings
 B. Pollutant(s) D. None of the above
57. Which of the following is removed and placed into a dumpster for disposal into the landfill?
 A. Liquids C. Debris
 B. Compounds D. None of the above
58. Which of the following passes into the Raw Influent Pumping process that consists of submersible centrifugal pumps?
 A. Wastewater C. Dissolved organic and inorganic constituents
 B. Grit and gravel D. None of the above

Primary Sedimentation

59. Pollutants that are dissolved or are very fine and remain suspended in the wastewater are easily removed effectively by gravity settling.
 A. True B. False
60. 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

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

- A. Very fine solids
- B. Wastewater
- C. Primary sludge
- D. None of the above

62. Which of the following 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. Suspended solids
- B. Grit and gravel
- C. Dissolved organic and inorganic constituents
- D. None of the above

Secondary Treatment

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

- A. True
- B. False

64. Maintaining a population of microorganisms within the oxidation basins which consumes the _____ and also adhere to the solids themselves.

- A. Total Solids
- B. Very fine solids
- C. Elevated Hardness, Salty Taste, or Corrosiveness
- D. None of the above

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

- A. Solid(s)
- B. Grit and gravel
- C. Finer solids
- D. None of the above

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

- A. Very fine solids
- B. Wastewater
- C. Primary sludge
- D. None of the above

67. The two most common conventional methods used to achieve secondary treatment are: which term and suspended growth processes?

- A. Solid(s)
- B. Attached growth processes
- C. Organic matter
- D. None of the above

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

- A. Oxidation Ditches
- B. Denitrification
- C. Excessive sludge production
- D. None of the above

69. The Preliminary Treatment stage removes as much _____ as possible using physical processes.

- A. Solid(s)
- B. Finer debris
- C. Suspended growth process(es)
- D. None of the above

Nutrient Removal Technologies

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

70. Which of the following 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) C. Aerobic nitrification processes
B. Fixed-film systems (FFSs) D. None of the above
71. Which of the following are typically constructed as beds of media through which wastewater flows?
- A. A closed loop C. Trickling filter FFSs
B. Nitrogen removal system(s) D. None of the above
72. Which of the following represents removal typically varies from 0 to 35 percent although removal percentages as high as 65%?
- A. Nitrified effluent C. Nitrogen and phosphorus levels
B. Nitrogen D. None of the above
73. Phosphorus removal is typically 1 to 1.5 percent.
- A. True B. False
74. Commercial on-site systems use synthetic media and receive wastewater from overlying sprayheads for anaerobic treatment and de-nitrification.
- A. True B. False
75. 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 C. Elevated Hardness, Salty Taste, or Corrosiveness
B. Total Nitrogen (TN) D. None of the above
76. 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 C. Phosphorus-reduction system(s)
B. Recirculation rates D. None of the above
77. Which of the following returns to the anoxic zone to mix with either septic tank contents or incoming septic tank effluent for denitrification?
- A. Filamentous organisms C. Nitrified effluent
B. Biosurfactant trehalose D. None of the above
78. Which of the following terms is discharged for disposal or further treatment?
- A. Ammonia oxidation C. Denitrified effluent
B. Oxygen demand of wastewater D. None of the above
79. According to the text, currently typical trickling filters systems are capable of producing effluent _____ concentrations of 5 to 40 mg/L.
- A. Nitrified effluent C. Nitrogen and phosphorus levels
B. BOD and TSS D. None of the above

Sequencing Batch Reactor (SBR)

80. 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

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

A. SBR process C. Cluster applications
B. Underdrain system D. None of the above

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

A. Trickling filter(s) C. SBRs
B. Nitrogen removal system(s) D. None of the above

83. Which of the following 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 C. Fixed-film bioreactor(s)
B. Sand filter(s) D. None of the above

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

A. Decanter C. Cluster applications
B. Underdrain system D. None of the above

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

A. Free water surface (FWS) systems C. Anaerobic septic tank effluent
B. SBRs D. None of the above

86. Several decanter configurations are available, including?

A. Fixed and floating units C. Septic tank effluent
B. Available adsorption sites D. None of the above

Intermittent Sand Filters (ISF)

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

A. True B. False

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

A. Oxidation Ditches C. Recirculating sand filters (RSFs)
B. Sand filters D. None of the above

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

A. SBR process C. Distribution network
B. Underdrain system D. None of the above

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

A. Decanter C. Fixed-film bioreactor(s)
B. Sand filter(s) D. None of the above

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

A. True B. False

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

A. Total Solids C. Elevated Hardness, Salty Taste, or Corrosiveness
B. Most suspended solids D. None of the above

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

A. Decanter C. Adsorption sites in the media
B. Chemical adsorption D. None of the above

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

A. Characteristics of the media C. Septic tank effluent
B. Recirculating filter(s) D. None of the above

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

A. Decanter C. Fixed-film bioreactor(s)
B. Sand filter(s) D. None of the above

96. Sand filters are frequently used to pretreat septic tank effluent prior to _____ where the soil has insufficient unsaturated depth.

A. Recirculating filter(s) C. Subsurface infiltration onsite
B. Available adsorption sites D. None of the above

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

A. Sand filter(s) C. Diffused air or mechanical devices
B. Chemical adsorption D. None of the above

Recirculating Sand Filters (RSF)

98. Recirculating filters using _____ provide advanced secondary treatment of settled wastewater or septic tank effluent.

A. Sand, gravel, or other media C. Phosphorus-reduction system(s)
B. Denitrification D. None of the above

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

A. Underdrain system C. Conventional recirculation tank
B. Free water surface (FWS) systems D. None of the above

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

A. True B. False

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

- A. Underdrain system
- B. Filter
- C. Conventional recirculation tank
- D. None of the above

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

- A. Trickling filter(s)
- B. RSFs
- C. Aerobic nitrification processes
- D. None of the above

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

- A. True
- B. False

Natural Systems

104. 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

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

- A. True
- B. False

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

- A. Underdrain system
- B. Wetlands
- C. Conventional recirculation tank
- D. None of the above

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

- A. Phosphorus removal
- B. Nitrate removal
- C. Aerobic decomposition
- D. None of the above

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

- A. Total Solids
- B. Phosphorus
- C. Elevated Hardness, Salty Taste, or Corrosiveness
- D. None of the above

109. 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. An aerobic wastewater treatment facility
- D. None of the above

110. 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. Phosphorus removal
- B. Nitrate removal
- C. Oxygen demand of wastewater
- D. None of the above

111. 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
- B. Phosphorus
- C. Wastewater
- D. None of the above

112. Duckweed are floating macrophytes.
A. True B. False
113. Duckweed fronds can double their mass in two days under ideal conditions of nutrient availability, sunlight, and temperature. Although duckweed can be found in most regions, the rate of growth is optimal at 20 to 30° C and they grow best in a pH range of 3.5 to 8.5.
A. True B. False
114. The wetland, effluent after two weeks is usually discharged by gravity to an unlined wetland bed, if these systems discharge effluent to oxidation ditches, they do not require a NPDES permit.
A. True B. False
115. Solids are filtered and finally settle out of the wastewater within the?
A. Conventional recirculation tank C. Free water surface (FWS) systems
B. Wetland D. None of the above
116. The emergent macrophytes can transmit the amount of oxygen from the leaves to their roots is negligible compared to the oxygen demand of wastewater, therefore _____ are devoid of oxygen.
A. Vertical flow wetland beds C. Subsurface flow wetlands
B. Nitrate removal D. None of the above
117. Which of the following terms are a modification of subsurface flow wetlands which contain gravel or coarse sand and are loaded intermittently at the top surface?
A. Vertical flow wetland beds C. Subsurface flow wetlands
B. Nitrate removal D. None of the above
118. Which of the following terms in a subsurface flow wetland can be rapid and effective because the anoxic conditions and carbon sources?
A. Vertical flow wetland beds C. Subsurface flow wetlands
B. Nitrate removal D. None of the above
119. Which of the following terms have been used for a number of years to treat wastewater for various purposes?
A. Duckweed C. Conventional recirculation tank
B. Anaerobic septic tank effluent D. None of the above
120. High levels of BOD and _____ removal have been observed from duckweed systems. To achieve secondary treatment most duckweed systems are coupled with either facultative or aerated ponds.
A. TDS C. TSS
B. pH D. None of the above
121. Nitrogen is removed by plant uptake and?
A. Filamentous organisms C. Harvesting, by denitrification
B. Biosurfactant trehalose D. None of the above

122. A disadvantage of duckweed systems is the large amount of biomass produced by the rapidly growing plants, which creates a _____ requirement.
- A. Ammonia oxidation
 - B. Phosphorus removal
 - C. Solids handling
 - D. None of the above

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

123. 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. Nitrogen
 - D. None of the above

124. Which of the following and pollution, nutrients could be recycled for agricultural use, and could be removed before being mixed with wastewater and released to the environment?
- A. TDS
 - B. pH
 - C. Nitrogen and phosphorus
 - D. None of the above

125. 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

126. 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. Nitrogen
 - D. None of the above

Nutrient Removal for Small Communities and Decentralized Wastewater Treatment Systems

127. Which of the following treat and dispose of effluent on the same property that produces the wastewater?
- A. Groundwater recharge
 - B. Community drainfield(s)
 - C. Onsite septic systems
 - D. None of the above

128. According to the text, wastewater from several homes is pretreated onsite by individual septic tanks before being transported through alternative sewers to _____ treatment unit that is relatively simple to operate and maintain.
- A. An offsite decentralized
 - B. Wastewater
 - C. Phosphorus-reduction system(s)
 - D. None of the above

129. Wastewater systems such as community drainfields, irrigation systems, and _____ are being installed to reduce infrastructure investment and minimize adverse environmental impacts.
- A. Package plants
 - B. Denitrification
 - C. Excessive sludge production
 - D. None of the above

130. Additional alternatives that include _____, sand filters, and constructed wetlands can be used to reduce nutrient pollution?
- A. Groundwater recharge
 - B. High-aluminum mud(s)
 - C. Aerobic tanks
 - D. None of the above

Phosphorus Removal

131. Few phosphorus removal processes are well developed for _____ application.

- A. Onsite wastewater systems
- B. Denitrification
- C. Phosphorus-reduction system(s)
- D. None of the above

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

- A. True
- B. False

133. Studies of high-iron sands and _____ indicate that 50 to 95 percent of the phosphorus can be removed?

- A. Groundwater recharge
- B. High-aluminum mud(s)
- C. Nitrogen and phosphorus pollution
- D. None of the above

Nitrogen Removal

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

- A. True
- B. False

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

- A. Groundwater recharge
- B. High-aluminum mud(s)
- C. Denitrification biological reactions
- D. None of the above

136. SBRs, and an array of _____ combined with an anoxic/anaerobic process to perform denitrification.

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Aerobic nitrification processes
- D. None of the above

137. There are systems that utilize membrane solids separation following _____ are capable of removing total nitrogen down to very low concentrations (i.e. 3 – 4 mg/L TN).

- A. Nitrogen removal system(s)
- B. Biological nitrification and denitrification
- C. Suspended film system(s)
- D. None of the above

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

- A. Oxidation Ditches
- B. Nitrogen removal system(s)
- C. Recirculating sand filters (RSFs)
- D. None of the above

Secondary Clarification Process

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

- A. True
- B. False

140. In the SCP, the majority of microorganism-rich underflow (or lower layer) is recirculated to Tanks as Return Sludge to help sustain the microorganism population in the?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Aerobic nitrification processes
- D. None of the above

Fixed Film Systems

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

- A. Mature biofilm
- B. Fixed film systems
- C. Application-specific microbiology
- D. None of the above

142. 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

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

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Aerobic nitrification processes
- D. None of the above

Suspended Film Systems

144. 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

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

- A. Nitrogen removal system(s)
- B. Tertiary process
- C. Suspended film system(s)
- D. None of the above

146. Activated sludge, _____, oxidation ditch, and sequential batch reactor systems are all examples of suspended film systems.

- A. Trickling filter(s)
- B. Extended aeration
- C. Aerobic nitrification processes
- D. None of the above

Lagoon Systems

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

- A. True
- B. False

148. Lagoon systems take advantage of _____ and microorganisms in the wastewater to renovate sewage.

- A. Tertiary process
- B. Natural aeration
- C. Recirculating sand filters (RSFs)
- D. None of the above

Other Important Wastewater Characteristics

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

- A. Treatment processes
- B. Effectiveness of treatment
- C. The environment
- D. None of the above

Temperature

150. Biological treatment activity accelerates in warm temperatures and slows in cool temperatures, but _____ can stop treatment processes altogether.

- A. High TSS
- B. Settling sediments
- C. Extreme hot or cold
- D. None of the above

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

A. True B. False

pH

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

A. True B. False

153. pH indicates increasing acidity while a low pH indicates increasing alkalinity.

A. True B. False

154. Which of the following needs to remain between 6 and 9 to protect organism?

A. TDS C. Wastewater temperature
B. pH D. None of the above

155. Other substances and some acids can alter _____ can inactivate treatment processes when they enter wastewater from industrial or commercial sources.

A. TDS C. Wastewater temperature
B. pH D. None of the above

Total Dissolved Solids

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

A. True B. False

157. Which of the following is a good solvent and picks up impurities easily?

A. Treatment processes C. Wastewater
B. Water D. None of the above

158. Which of the following refer to any minerals, salts, metals, cations or anions dissolved in water?

A. Total Solids C. Elevated Hardness, Salty Taste, or Corrosiveness
B. Dissolved solids D. None of the above

159. Which of the following comprise inorganic salts and some small amounts of organic matter that are dissolved in water?

A. Total dissolved solids (TDS) C. Universal solvent
B. Quality of the water D. None of the above

160. TDS in drinking-water originate from natural sources, sewage, urban run-off, industrial wastewater, and chemicals used in the water treatment process.

A. True B. False

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

A. True B. False

162. Which of the following has been due to natural environmental features such as: mineral springs, carbonate deposits, salt deposits, and sea water intrusion?

A. Total Solids C. Elevated Hardness, Salty Taste, or Corrosiveness
B. TDS D. None of the above

163. Which of the following is the concentration is the sum of the cations (positively charged) and anions (negatively charged) ions in the water?

- A. Total dissolved solids (TDS) C. Corrosiveness
B. Total Solids D. None of the above

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

- A. Total dissolved solids (TDS) C. Corrosiveness
B. Total Solids D. None of the above

Total Solids

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

- A. Total dissolved solids (TDS) C. Corrosiveness
B. Total Solids D. None of the above

166. Which of the following—are the term used for material left in a container after evaporation and drying of a water sample?

- A. Total dissolved solids (TDS) C. Corrosiveness
B. Total Solids D. None of the above

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

- A. Total Solids C. Elevated Hardness, Salty Taste, or Corrosiveness
B. pH D. None of the above

168. Which of the following 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 C. Total Suspended solids
B. Total dissolved solids (TDS) D. None of the above

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

- A. True B. False

Total Suspended Solids (TSS)

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

- A. True B. False

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

- A. High TSS C. Suspended sediment
B. Settling sediments D. None of the above

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

- A. Total Solids C. TSS
B. TDS D. None of the above

173. Estimating which 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. Flow volume(s)
- B. Additional flows
- C. Original design load
- D. None of the above

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

- A. BOD and COD
- B. Some contaminants
- C. Soluble nutrients
- D. None of the above

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

- A. Biological processes
- B. Activated sludge system
- C. Application-specific microbiology
- D. None of the above

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

- A. Biofilm
- B. Some contaminants
- C. Soluble nutrients
- D. None of the above

Application Specific Microbiology

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

- A. Mature biofilm
- B. Activated sludge system
- C. Application-specific microbiology
- D. None of the above

Advanced Methods of Wastewater Treatment

178. 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. Some contaminants
- B. Secondary treatment effluent
- C. Oxygen and organic waste
- D. None of the above

179. Pretreatment and pollution prevention which helps limit _____ discharged to the sanitary sewer system.

- A. Types of wastes
- B. Pretreatment and pollution prevention
- C. Application-specific microbiology
- D. None of the above

180. All WWTPs provide a minimum of?

- A. Primary
- B. Secondary treatment
- C. Pretreatment and pollution prevention
- D. None of the above

Advanced Treatment Technologies

181. Treatment levels beyond secondary are called advanced treatment.

- A. True
- B. False

Nitrogen Control

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

- A. True B. False

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

- A. True B. False

184. Nitrogen in the form of _____ can exert a direct demand on oxygen or stimulate the excessive growth of algae.

- A. Ammonia C. Non-toxic nitrate
B. Denitrification D. None of the above

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

- A. Nitrification C. Nitrogen in the nitrate form
B. Biological treatment D. None of the above

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

- A. Denitrification C. Additional biological
B. Nitrate nitrogen D. None of the above

Conversion of Nitrate to Nitrogen Gas

187. The conversion of nitrate to _____ is accomplished by bacteria in a process known as denitrification.

- A. Nitrogen gas C. Nitrate nitrogen
B. Methanol D. None of the above

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

- A. Nitrogen gas C. Nitrate nitrogen
B. Methanol D. None of the above

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

- A. Phosphorus C. Carbon
B. Nitrogen D. None of the above

Biological Phosphorus Control

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

- A. Both nitrogen and phosphorus C. Nitrate nitrogen
B. Oxygen D. None of the above

191. 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. Nitrogen gas C. Nitrate nitrogen
B. Methanol D. None of the above

Coagulation-Sedimentation Process

192. 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

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

A. Carbon adsorption c. Chemical coagulation-sedimentation
B. An advanced process D. None of the above

194. Which of the following is added to the wastewater to remove phosphorus?

A. Other alkaline materials C. Alum, lime, or iron salts are chemicals
B. Phosphate D. None of the above

Carbon Adsorption

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

A. Denitrification process C. Insufficient aeration in the reactor
B. Biological treatment D. None of the above

Water Quality Criteria

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

A. True B. False

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

A. True B. False

Aerobic Processes

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

A. True B. False

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

A. Attached growth processes C. Suspended growth processes
B. Activated sludge processes D. None of the above

200. Food (organic loading) regulates?

A. Predators C. Many bacterial species
B. Microorganism numbers D. None of the above

Aerobic Bacteria

201. Three bacteria groups occur: freely dispersed, single bacteria; floc-forming bacteria; and filamentous bacteria. All function similarly to oxidize organic carbon to produce CO₂ and new bacteria.

A. True B. False

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

- A. Anaerobic action
- B. BOD
- C. Aerobic bacteria
- D. None of the above

Nitrification

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

- A. Nitrifying bacteria
- B. Methane forming bacteria
- C. Aerobic bacteria
- D. None of the above

Anaerobic Bacteria

204. Which of the following commonly occur in lagoons are involved in methane formation and in sulfate reduction?

- A. Methane forming bacteria
- B. Only two bacteria
- C. Anaerobic, heterotrophic bacteria
- D. None of the above

205. Anaerobic methane formation involves _____ bacteria.

- A. Three different groups of anaerobic
- B. Acid-forming bacteria
- C. Organic overloading conditions
- D. None of the above

Photosynthetic Organisms

206. Which of the following bacteria convert formic acid, methanol, methylamine, and acetic acid under anaerobic conditions to methane?

- A. Nitrifying bacteria
- B. Methane forming bacteria
- C. Aerobic bacteria
- D. None of the above

Protozoans and Microinvertebrates

207. Which of the following best describe relatively slow growing and only occur in systems with a detention time of >10 days?

- A. Bacteria and algae
- B. Protozoans
- C. Microinvertebrates
- D. None of the above

208. 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

209. 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

Common Types

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

- A. True
- B. False

Paramecium sp.

211. Which of the following is a medium to large size (100-300 µm) swimming ciliate, commonly observed in activated sludge, sometimes in abundant numbers?

- A. Shelled amoeba(s)
- B. Vorticella
- C. Paramecium
- D. None of the above

212. Which of the following is described as a filter-feeding ciliate because its cilia move and filter bacteria from the water?

- A. Euglypha
- B. Vorticella
- C. Paramecium
- D. None of the above

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

- A. True
- B. False

214. After reproducing, the offspring develops a band of swimming cilia and goes off to form its own stalk, the evicted organism is called a?

- A. Shelled amoeba(s)
- B. Vorticella
- C. Swarmer
- D. None of the above

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

- A. Shelled amoeba(s)
- B. Euglypha
- C. Stalked ciliate
- D. None of the above

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

- A. True
- B. False

217. According to the text, Euchlanis is commonly found in?

- A. Biofilm bacteria
- B. Filamentous bacteria
- C. Activated sludge
- D. None of the above

218. Which of the following secrete sticky substances that form a sort of gel in which they live?

- A. Biofilm bacteria
- B. Filamentous bacteria
- C. Activated sludge
- D. None of the above

Filamentous Bacteria

219. Which of the following are a type of bacteria that can be found in a wastewater treatment system?

- A. Filamentous Bacteria
- B. Facultative
- C. Either anaerobic or aerobic conditions
- D. None of the above

Site Specific Bacteria

220. Aeration and biofilm building are the key operational parameters that contribute to the efficient degradation of organic matter (BOD/COD removal).

- A. True
- B. False

221. Which of the following become site-specific as the biofilm develops and matures and is even more efficient in treating the site-specific waste stream?

- A. Anaerobic action
- B. Facultative bacteria
- C. Application-specific bacteria
- D. None of the above

Facultative Bacteria

222. 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

Anaerobic Bacteria

223. Which of the following terms live and reproduce in the absence of free oxygen?

- A. Anaerobic action
- B. Anaerobic bacteria
- C. Aerobic bacteria
- D. None of the above

224. In order to remove a given amount of organic material in an anaerobic treatment system, the organic material must be exposed to a _____ and/or detained for a much longer period of time.

- A. Absence of free oxygen
- B. Facultative bacteria
- C. Significantly higher quantity of bacteria
- D. None of the above

Aerobic Bacteria

225. Aerobic bacteria live and multiply in the presence of free oxygen.

- A. True
- B. False

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

- A. True
- B. False

227. The metabolism of aerobes is much higher than?

- A. Nematodes and rotifers
- B. Anaerobes
- C. Aerobic bacteria
- D. None of the above

Protozoans and Metazoans

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

- A. Metazoan(s)
- B. Protozoan(s)
- C. Aerobic floc
- D. None of the above

229. Which of the following are also indicators of biomass health and effluent quality?

- A. Organic material
- B. Protozoans
- C. Biomass health and effluent quality
- D. None of the above

Dispersed Growth

230. 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

Activated Sludge Aerobic Flocs

231. 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

232. Wastewater treatment efficiencies and removal levels are so much improved that additional downstream treatment components are?

A. Insufficient aeration C. Dramatically reduced or totally eliminated
B. Bulking sludge D. None of the above

Problems may appear during the operation of activated sludge systems, including:

233. 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 C. Biomass health and effluent quality
B. High solids D. None of the above

234. Odors, caused by _____ in the settling tanks or insufficient aeration in the reactor.

A. Denitrification process C. Insufficient aeration in the reactor
B. Anaerobic conditions D. None of the above

Filamentous Organisms

235. Which of the following reach too high a concentration, they can extend dramatically from the floc particles?

A. Filamentous organisms C. Process control variation
B. Organic material D. None of the above

236. Because of the increased surface area and without a corresponding increase in mass, this will not settle well?

A. Larger floc particles C. Biomass
B. Activated sludge D. None of the above

237. Due to the high surface area of which term will reach an excess concentration?

A. Floc particles C. Filamentous bacteria
B. Organic material D. None of the above

Filamentous Bacteria Identification

238. 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

239. 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

240. *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

241. 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. Disruptive foaming
- C. Gram-positive, chemoautotrophic, filamentous
- D. None of the above

242. *Microthrix parvicella* is another common cause of?

- A. Staining gram-positive
- B. Mixotrophic
- C. Disruptive foaming
- D. None of the above

243. *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

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

- A. True
- B. False

245. *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

246. *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

Filamentous Bacteria

247. 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

Other Wastewater Treatment Components

Biochemical Oxygen Demand

248. Which of the following reflects high concentrations of substances that can be biologically degraded, thereby consuming oxygen?

- A. Organic carbon
- B. Domestic wastewater
- C. High BOD
- D. None of the above

Nutrient Constituents in Wastewater and Measurement Methods

Nitrogen

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

- A. True
- B. False

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

- A. Sludge bulking
- B. Dissolved oxygen decrease
- C. Inflow and infiltration to the collection system
- D. None of the above