

Registration form

ACTIVATED SLUDGE CEU TRAINING COURSE \$150.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00

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

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

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

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Operator ID # _____ **Exp. Date** _____

Class/Grade _____ List hours worked must match State Requirement. _____

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

Collection ___ Wastewater Treatment ___ Pretreatment ___ Other _____

Your certificate will be e-mailed to you in about two weeks unless you pay for the rush service.

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

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

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.

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.

Please provide a copy of your driver's license to confirm your identity.

Do not solely depend on TLC's Approval list for it may be outdated.

All downloads are electronically tracked and monitored for security purposes.

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Activated Sludge Answer Key

Name _____

Phone # _____

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

Method of Course acceptance confirmation. Please fill this section

Website ___ Telephone Call ___ Email ___ Spoke to _____

Did you receive the approval number, if applicable? _____
Do not solely depend on TLC's Approval list for it may be outdated.

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.

Please select one answer. You can circle, underline, bold or X the answer.

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| 1. A B C D E F | 16. A B C D E F | 31. A B C D E F |
| 2. A B C D E F | 17. A B C D E F | 32. A B C D E F |
| 3. A B C D E F | 18. A B C D E F | 33. A B C D E F |
| 4. A B C D E F | 19. A B C D E F | 34. A B C D E F |
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| 9. A B C D E F | 24. A B C D E F | 39. A B C D E F |
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| 163. | A B C D E F | 181. | A B C D E F | 199. | A B C D E F |
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Addition certificates of Completion for a second State Agency \$50 fee

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 be in compliance and do not follow this course for proper compliance.

Please e-mail or fax your answers and registration form to TLC.

Please mail or fax this survey along with your final exam

**ACTIVATED SLUDGE CEU COURSE
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Any other concerns or comments.

Please fax or e-mail the answer key to TLC info@tlch2o.com
Western Campus Fax (928) 272-0747.

Always call to confirm we have received your work.

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 have received your assignment and to confirm your identity.

Thank you...

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.

Activated Sludge CEU Training Course Assignment

The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit 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.

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your manual 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**

Basic Wastewater Treatment Processes

Physical

1. One of the physical processes for wastewater treatment involves removal of particles that float on top of the water because they have _____.
A. Biosolids
B. Activated Sludge
C. Chemicals
D. Organic material
E. Entrapped air
F. None of the Above

Biological

2. 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. Hydrogen sulfide
E. Nitrogen
F. None of the Above
3. In the 1920s, scientists figured out how to contain and accelerate _____ to remove organic material from wastewater.
A. These natural biological processes
B. Activated Sludge
C. Chemicals
D. Organic material
E. Entrapped air
F. None of the Above
4. The addition of _____ to the biological process causes masses of microorganisms to grow and rapidly metabolize organic materials.
A. Oxygen
B. Carbon dioxide
C. Gravity
D. Hydrogen sulfide
E. Nitrogen
F. None of the Above
5. The process of saturating sewage with air and microorganisms to break down the organic matter is called _____.
A. Biosolids
B. Activated Sludge
C. Chemicals
D. Organic material
E. Entrapped air
F. None of the Above

6. 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

Chemical

7. Chemicals can be added to change pollutants into new forms that can be removed by physical processes.
- A. True
 - B. False
8. 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. Biosolids
 - B. Activated Sludge
 - C. Simple chemicals
 - D. Organic materials
 - E. Entrapped air
 - F. None of the Above
9. 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
10. _____ are added to improve the settling of excess microbiological growth or biosolids in the later stages of treatment.
- A. Biosolids
 - B. Activated Sludge
 - C. Chemicals
 - D. Organic materials
 - E. Polymers
 - F. None of the Above

Introduction to Activated Sludge

11. The activated sludge process uses air (oxygen) and aerobic microorganisms to digest organic matter in wastewater and create a biological floc that will readily settle out.
- A. True
 - B. False
12. A conventional activated sludge process includes an aeration tank, a settling tank, and in some cases a system to return activated sludge to the beginning of the process or to other locations.
- A. True
 - B. False
13. The biological flocs settle in the final clarifier, thus separating the biological sludge from the clear treated water.
- A. True
 - B. False

Essential Wastewater Treatment Terms

14. When free or dissolved oxygen is present in the aquatic environment, the condition is called aerobic.
A. True B. False
15. Aerobic bacteria require an environment containing oxygen to live and reproduce.
A. True B. False
16. Aerobes can use chemically combined oxygen, such as in water molecules, for respiration.
A. True B. False
17. When free or dissolved oxygen is not present in the aquatic environment, the condition is called anaerobic.
A. True B. False
18. Anaerobic bacteria need oxygen to thrive.
A. True B. False
19. Saprophytic bacteria break down complex solids to volatile acids.
A. True B. False
20. The volatile acids are broken down by bacteria known as methane fermenters to form methane, carbon dioxide, and water.
A. True B. False
21. The addition of oxygen, removal of hydrogen, or removal of an electron to/from an element or compound in a chemical reaction is called oxidation.
A. True B. False
22. The removal of oxygen, addition of hydrogen, or addition of electrons to/from an element or compound in a chemical reaction is called reduction.
A. True B. False
23. Sulfur compounds, or elemental sulfur, are reduced to H₂S or sulfide ions under anaerobic conditions in wastewater.
A. True B. False

Important Wastewater Characteristics

24. Wastewater characteristics can affect public health, the environment, and the design, cost, and _____.
A. Treatment processes D. The environment
B. Total dissolved solids (TDS) E. Effectiveness of treatment
C. Quality of the water F. None of the Above

Organic Matter

25. _____, such as proteins, carbohydrates, or fats, can cause pollution of receiving waters.
A. Long chained compounds D. Wastewater-related sources
B. Biodegradable organics E. Oxygen compounds
C. Inorganic materials F. None of the Above

26. Organisms use dissolved oxygen in the water to break down biodegradable materials. This process is dangerous to aquatic life because the _____ in the water is reduced or depleted.
- | | |
|---------------------|-----------------------------|
| A. Sediment | D. Graywater and blackwater |
| B. Supply of oxygen | E. Nitrogen |
| C. Hydrogen | F. None of the Above |
27. The _____ of wastewater is the amount of oxygen that organisms need to break down the biodegradable materials in the wastewater.
- | | |
|------------------------------------|-------------------------------|
| A. Biochemical oxygen demand (BOD) | D. Wastewater-related sources |
| B. Biodegradable materials | E. Oxygen |
| C. Organic materials | F. None of the Above |
28. Many _____ used by agriculture and industries cannot be quickly broken down by organisms, making treatment more difficult.
- | | |
|-------------------------|--------------------------------|
| A. Inorganic substances | D. Graywater and blackwater |
| B. Organic materials | E. Synthetic organic compounds |
| C. Organic compounds | F. None of the Above |
29. Certain synthetic organics, such as _____, are toxic to humans, fish, and aquatic plants.
- | | |
|------------------------------|------------------------------|
| A. BOD | D. Pesticides and herbicides |
| B. Most inorganic substances | E. Turbidity |
| C. Nitrogen and phosphorus | F. None of the Above |
30. Solvents and pesticides contain toxic _____ such as benzene and toluene.
- | | |
|------------------------------|----------------------|
| A. Nutrients from wastewater | D. Excessive grease |
| B. Inorganic materials | E. Organic compounds |
| C. Inorganic minerals | F. None of the Above |

Oil and Grease (Scum)

31. Fatty organic materials from animals, vegetables, and petroleum are quickly broken down by bacteria and therefore are not a source of pollution.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|
32. The _____ of receiving waters is increased when large amounts of oils and greases are discharged from community systems.
- | | |
|----------------------------|-------------------------------|
| A. BOD | D. Bacteria |
| B. Inorganic substances | E. Petroleum-based waste oils |
| C. Nitrogen and phosphorus | F. None of the Above |
33. _____ adds to the scum layer in a septic tank, which in turn requires that the tank be pumped more often.
- | | |
|------------------------------|----------------------------|
| A. Nutrients from wastewater | D. Excessive grease |
| B. Inorganic materials | E. Nitrogen and phosphorus |
| C. Inorganic minerals | F. None of the Above |

34. Hazardous wastes such as _____ should be collected and disposed of separately from wastewater.
- | | |
|------------------------------|-------------------------------|
| A. BOD | D. Pesticides and herbicides |
| B. Most inorganic substances | E. Petroleum-based waste oils |
| C. Nitrogen and phosphorus | F. None of the Above |

Inorganics

35. Residential and nonresidential sources both contribute inorganic minerals, metals, and compounds to wastewater.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|
36. Organisms in wastewater cannot easily break down _____, since these substances are relatively stable.
- | | |
|------------------------------|-------------------------------|
| A. Most organic substances | D. Pesticides and herbicides |
| B. Most inorganic substances | E. Petroleum-based waste oils |
| C. Nitrogen and phosphorus | F. None of the Above |
37. The removal of _____ from industrial wastewater sources often requires additional treatment steps.
- | | |
|------------------------------|----------------------|
| A. Nutrients from wastewater | D. BOD |
| B. Inorganic materials | E. DON |
| C. Organic materials | F. None of the Above |
38. Heavy metals in industrial wastewater discharges are difficult to remove by conventional treatment methods.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|

Nutrients

39. Wastewater normally contains an excess of available nutrients since organisms only require small amounts of nutrients during biological treatment.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|
40. The chief nutrients present in natural water that are essential to living organisms are _____.
- | | |
|------------------------|-------------------------------------|
| A. Oxygen | D. Carbon, nitrogen, and phosphorus |
| B. Ecology | E. Phosphorus and nitrogen |
| C. Nutrient enrichment | F. None of the Above |
41. Phosphorous and nitrogen cannot be substantially removed by conventional _____.
- | | |
|------------------------|---|
| A. Biofilm | D. Secondary biological treatment processes |
| B. Contaminants | E. Oxygen and organic waste |
| C. Secondary treatment | F. None of the Above |
42. An excess of nitrogen and phosphorous causes water plants to grow slowly.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|

43. Large amounts of nutrients, primarily _____ but sometimes nitrogen, cause nutrient enrichment that leads to excessive algae growth.
- | | |
|------------------------|------------------------------|
| A. Phosphorus | D. Excessive growth of algae |
| B. Heavy metals | E. Nitrogen |
| C. Nutrient enrichment | F. None of the Above |
44. Aquatic plants and animals are harmed when uncontrolled algae growth blocks out the sunlight, thereby depleting _____ in the water at night.
- | | |
|------------------------|------------------------------|
| A. Pathogens | D. Excessive growth of algae |
| B. Dissolved oxygen | E. Phosphorus and nitrogen |
| C. Nutrient enrichment | F. None of the Above |
45. When a waterbody cannot assimilate all of the nutrients, the resulting condition is called _____.
- | | |
|------------------------|--|
| A. Toxic | D. Eutrophication or cultural enrichment |
| B. Ecology | E. Oxygen and organic waste |
| C. Nutrient enrichment | F. None of the Above |

Application Specific Microbiology

46. Wastewater treatment plants use a methodology known as _____ to achieve the most efficient 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 |
47. 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
48. When starting up an activated sludge process, _____ can be purchased to reduce the time for growing a mature biofilm.
- | | |
|------------------------------------|--|
| A. Mature biofilms | D. Application specific bacterial cultures |
| B. Activated sludge systems | E. Pretreatment and pollution prevention |
| C. Advanced treatment technologies | F. None of the Above |

Hydrogen Sulfide and Ammonia

49. Hydrogen sulfide and _____ are gasses that can be toxic and pose asphyxiation hazards.
- | | |
|---------------------|----------------------|
| A. Ammonia | D. Oxygen |
| B. Wastewater odors | E. Less oxygen |
| C. Air | F. None of the Above |
50. Ammonia as a dissolved gas in wastewater is not dangerous to fish.
- A. True B. False
51. Cleaner sewers will produce less hydrogen sulfide because they will harbor _____.
- | | |
|-------------------------|----------------------|
| A. Fewer slime bacteria | D. BOD |
| B. Wastewater odors | E. Less oxygen |
| C. Hydrogen sulfide | F. None of the Above |

52. Hydrogen sulfide can be reduced by using _____ to precipitate sulfides, and by killing bacteria that produce hydrogen sulfide using lime treatments.
- | | |
|---------------------------|--------------------------------------|
| A. Dissolved oxygen | D. Biochemical oxygen demand, or BOD |
| B. Salts of zinc and iron | E. Wastewater odors |
| C. Magnesium hydroxide | F. None of the Above |
53. The lack of oxygen causes _____ conditions to occur in the sewer system.
- | | |
|---------------------|----------------------|
| A. Slime bacteria | D. Aerobic |
| B. Wastewater odor | E. Less oxygen |
| C. Hydrogen sulfide | F. None of the Above |
54. The mental well-being and _____ of residents can be affected by uncontained wastewater odors.
- | | |
|--------------------|----------------------|
| A. Attitude | D. Political views |
| B. Income | E. Social activities |
| C. Quality of life | F. None of the Above |

Pollutants, Oxygen-Demanding Substances

55. Aquatic life needs _____ in the water to survive.
- | | |
|------------------------|--------------------------------------|
| A. Dissolved oxygen | D. Biochemical oxygen demand, or BOD |
| B. Oxygen-demand | E. Wastewater odors |
| C. Magnesium hydroxide | F. None of the Above |
56. The biochemical oxygen demand (BOD) of the effluent is not an indicator of how well a sewage treatment plant is working.
- A. True B. False
57. If the wastewater treatment plant effluent has a high content of organics or ammonia, more _____ will be demanded from the receiving water. This will leave less oxygen to support fish and aquatic plants.
- | | |
|---------------------|----------------------|
| A. Slime bacteria | D. Nitrogen |
| B. Wastewater odors | E. Oxygen |
| C. Hydrogen sulfide | F. None of the Above |
58. Both organic matter and _____ are called "oxygen-demanding" substances.
- | | |
|------------------------|--------------------------------------|
| A. Dissolved oxygen | D. Biochemical oxygen demand, or BOD |
| B. Ammonia | E. Wastewater odors |
| C. Magnesium hydroxide | F. None of the Above |
59. Domestic sewage and _____ all contribute oxygen-demanding substances to wastewater.
- | | |
|---------------------|---------------------------------------|
| A. Slime bacteria | D. The lack of oxygen |
| B. Wastewater odors | E. Agricultural and industrial wastes |
| C. Hydrogen sulfide | F. None of the Above |

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

Pathogens

61. Sewage from cities and institutions, industrial wastes from tanning and meat packing plants, and storm water runoff containing animal wastes can all be sources of pathogens in surface and ground water.
- A. True B. False
62. Modern disinfection techniques for wastewater and drinking water have greatly reduced the danger of waterborne disease.
- A. True B. False

Inorganic and Synthetic Organic Chemicals

63. Inorganic and synthetic organic chemicals are not toxic to fish and aquatic life.
- A. True B. False
64. Some inorganic and synthetic organic chemicals are _____ at very low concentrations.
- | | |
|---------------------|--------------------------|
| A. Highly poisonous | D. Safe for aquatic life |
| B. Ecology | E. Non-toxic to humans |
| C. Nutrient rich | F. None of the Above |

Thermal

65. The capacity of water to retain oxygen is reduced by _____.
- | | |
|------------------------|------------------------------|
| A. Heat | D. Excessive growth of algae |
| B. Heavy metals | E. Phosphorus and nitrogen |
| C. Nutrient enrichment | F. None of the Above |
66. The ecology of a lake or stream can be seriously altered by uncontrolled discharges of _____.
- | | |
|---------------|----------------------------|
| A. Toxics | D. Oxygen |
| B. Waste heat | E. Phosphorus and nitrogen |
| C. Nutrients | F. None of the Above |

Other Important Wastewater Characteristics

Temperature

67. Temperatures ranging from 77 to 95 degrees Fahrenheit are probably best for wastewater treatment.
- A. True B. False
68. While warm temperatures accelerate biological processes and cool temperatures slow them down, _____ can stop treatment processes altogether.
- | | |
|-----------------------|---------------------------------|
| A. Oxygen | D. Total Suspended Solids (TSS) |
| B. High TSS | E. Extreme hot or cold |
| C. Settling sediments | F. None of the Above |

88. Primary treatment processes, such as sedimentation or gravity settling, chemical coagulation, or filtration, are used to remove _____ from the wastewater.
- | | |
|---------------------|------------------------|
| A. Suspended solids | D. Primary sludge |
| B. Sewage | E. Grit and screenings |
| C. Pollutants | F. None of the Above |
89. Pollutants that are dissolved in the wastewater are effectively removed by gravity settling.
- A. True B. False
90. 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 | D. Primary sludge |
| B. Wastewater pollution | E. Grit and screenings |
| C. Pollutants | F. None of the Above |

Secondary Treatment

91. After the primary treatment processes, the _____ flows to the secondary treatment processes.
- | | |
|---------------------|----------------------|
| A. Very fine solids | D. Primary sludge |
| B. Wastewater | E. Grit |
| C. Pollutant load | F. None of the Above |
92. The _____ and the suspended growth processes are the most common conventional methods used to achieve secondary treatment.
- | | |
|------------------------------|---------------------------------|
| A. Solids | D. Unsuspended growth processes |
| B. Finer debris | E. Organic matter |
| C. Attached growth processes | F. None of the Above |
93. The secondary treatment stage includes a biological process, such as _____, and a physical process known as secondary clarification.
- | | |
|----------------------|---------------------------------|
| A. Wildlife habitat | D. Phosphorus-reduction systems |
| B. Oxidation ditches | E. Excessive sludge production |
| C. Denitrification | F. None of the Above |
94. After preliminary treatment, the _____ are still present in the wastewater, since they cannot be removed by physical processes.
- | | |
|---------------------|-------------------------------|
| A. Very fine solids | D. Suspended growth processes |
| B. Coarse debris | E. Larger debris |
| C. Grit and gravel | F. None of the Above |
95. The wastewater from preliminary treatment flows directly into the secondary clarifier.
- A. True B. False

96. The _____ (which are primarily organic) are consumed by microorganisms within the oxidation basins. The microorganisms also adhere to the solids themselves.
- | | |
|---------------------|------------------------|
| A. Total Solids | D. Grit and screenings |
| B. TDS | E. Sludge |
| C. Very fine solids | F. None of the Above |
97. The microorganisms in the oxidation basins consume and adhere to the finer solids. This causes _____ to form, which can be physically separated.
- | | |
|--------------------|---|
| A. Solids | D. Larger and heavier aggregates |
| B. Finer debris | E. Dissolved organic and inorganic constituents |
| C. Grit and gravel | F. None of the Above |
98. After the oxidation ditches, the wastewater enters the secondary clarification process.
- A. True B. False

Aerobic Processes

99. Activated sludge systems, lagoons, trickling filters and rotating disk contactors are the most common aerobic processes.
- A. True B. False

Nitrogen Control

100. Nitrogen in wastewater is usually not removed by secondary treatment.
- A. True B. False
101. Nitrogen in the form of _____ can consume oxygen or stimulate algae growth.
- | | |
|------------------|-------------------------------------|
| A. Nitrification | D. Nitrogen in the nitrate form |
| B. Ammonia | E. Ammonia to the non-toxic nitrate |
| C. Nitrogen | F. None of the Above |
102. Ammonia in wastewater is not toxic to aquatic life.
- A. True B. False
103. A biological treatment process beyond the secondary stage uses nitrifying bacteria to convert ammonia to non-toxic nitrate. This process is called _____.
- | | |
|--------------------|---------------------------------|
| A. Nitrification | D. Nitrogen in the nitrate form |
| B. Denitrification | E. Biological treatment |
| C. Nitrogen | F. None of the Above |
104. To remove nitrate from wastewater effluent, another _____ process can be added to convert nitrate to nitrogen gas.
- | | |
|------------------|----------------------|
| A. Nitrification | D. Primary |
| B. Chemical | E. Biological |
| C. Physical | F. None of the Above |

Conversion of Nitrate to Nitrogen Gas

105. Nitrate can be converted to _____ by bacteria in a process known as denitrification.
- A. Nitrogen gas
 - B. Phosphorus
 - C. Nitrogen
 - D. Nitrate nitrogen
 - E. Methanol
 - F. None of the Above

Biological Phosphorus Control

106. Phosphorous needs to be removed from wastewater effluent to prevent excessive algal growth in the receiving waters.
- A. True
 - B. False
107. One way to remove _____ is the addition of chemicals and a coagulation-sedimentation process.
- A. Nitrification
 - B. Phosphorus
 - C. Nitrogen
 - D. Nitrate nitrogen
 - E. Oxygen
 - F. None of the Above
108. Biological nutrient removal (BNR) processes can remove _____.
- A. Both nitrogen and phosphorus
 - B. Phosphorus
 - C. Nitrogen
 - D. Nitrate nitrogen
 - E. Oxygen
 - F. None of the Above
109. BNR processes are modified suspended growth treatment systems. The bacteria in these systems also convert _____ to inert nitrogen gas, and cause phosphorous to be trapped in the solids that are subsequently removed.
- A. Both nitrogen and phosphorus
 - B. Phosphorus
 - C. Nitrogen
 - D. Nitrate nitrogen
 - E. Oxygen
 - F. None of the Above

Water Quality Criteria Section

110. 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
111. 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

112. Humans can be exposed to water pollutants by drinking untreated surface water or eating fish or wildlife that have been contaminated by pollutants in surface water.
- A. True
 - B. False
113. EPA scientists determine the levels for specific chemicals which are not likely to adversely affect human health.
- A. True
 - B. False

The Microlife or Microorganisms

122. In wastewater treatment, carbonaceous BOD is degraded using _____.
- A. Carbonaceous BOD
 - B. Attached growth processes
 - C. Activated sludge processes
 - D. Suspended growth processes
 - E. Food-to-microorganism ratio, F/M
 - F. None of the Above
123. Pilot plant and laboratory studies are required to design _____.
- A. Effluent quality
 - B. Organic load
 - C. Bacteria
 - D. Nitrogen and phosphorus load
 - E. Activated sludge plants
 - F. None of the Above
124. An activated sludge process can be designed based on the amount of time the sludge spends in the system. This is referred to as the _____.
- A. Carbonaceous BOD
 - B. Attached growth processes
 - C. Mean cell residence time (MCRT)
 - D. Suspended growth processes
 - E. Food-to-microorganism ratio, F/M
 - F. None of the Above
125. An activated sludge process can be designed based on the amount of food provided to the bacteria in the aeration tank. This is referred to as the _____.
- A. Carbonaceous BOD
 - B. Attached growth processes
 - C. Mean cell residence time (MCRT)
 - D. Suspended growth processes
 - E. Food-to-microorganism ratio, F/M
 - F. None of the Above

Microorganisms in Lagoons and Activated Sludge

126. 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
127. All groups of aerobic bacteria oxidize organic carbon (BOD) to produce CO₂ and new bacteria.
- A. True
 - B. False
128. _____ 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
129. _____ grow in a large aggregate (floc).
- A. Treatment organisms
 - B. Aerobic bacteria
 - C. Stalked ciliates
 - D. Floc-forming bacteria
 - E. Filamentous bacteria
 - F. None of the Above
130. 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

131. _____ can be found in lagoons at specific growth environments.
- | | |
|---------------------------|----------------------------------|
| A. Activated sludge | D. Anaerobic bacteria |
| B. Absence of free oxygen | E. Application-specific bacteria |
| C. Filamentous bacteria | F. None of the Above |
132. Filamentous bacteria do not cause operational problems in lagoons, but cause filamentous bulking and _____ in activated sludge processes.
- | | |
|-------------------|---------------------------|
| A. Strict aerobes | D. Poor sludge settling |
| B. Predators | E. Many bacterial species |
| C. Bacteria | F. None of the Above |
133. 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
134. BOD removal decreases rapidly below 3-4°C and ceases at 1-2°C.
- A. True B. False
135. Ammonia can be oxidized to nitrate by _____.
- | | |
|------------------------|---------------------------|
| A. Strict aerobes | D. Heterotrophic bacteria |
| B. Predators | E. Many bacterial species |
| C. Nitrifying bacteria | F. None of the Above |

Bacteria Section

136. Bacteria shapes can be round spheres (cocci), cylindrical (rods), or twisted, bent, or curved rods (spirilla).
- A. True B. False
137. Tightly coiled up bacteria are called _____.
- | | |
|----------|----------------------|
| A. Cocci | D. Spiral |
| B. Rods | E. Spirochaetes |
| C. Balls | F. None of the Above |
138. Bacteria do not live alone, but live together in clumps, chains, or planes.
- A. True B. False
139. _____ 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 |
140. 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 |
141. _____ 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

142. Filamentous bacteria found in wastewater function similar to _____. They degrade BOD well and add stability and backbone to the floc structure.
- A. Biofilm bacteria
 - B. Filamentous bacteria
 - C. Some bacteria
 - D. Activated sludge
 - E. Floc forming bacteria
 - F. None of the Above
143. 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

144. The efficient degradation of organic matter depends on two key operational parameters – aeration and biofilm building.
- A. True
 - B. False
145. _____ become site-specific over time as the biofilm develops and matures. The site-specific bacteria are even more effective in treating the waste stream at that particular treatment plant.
- 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

146. Facultative bacteria can survive and multiply in either anaerobic or aerobic conditions.
- A. True
 - B. False
147. 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
148. 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

149. _____ 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

150. 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 | D. Aerobic bacteria |
| B. Free oxygen | E. A significantly higher quantity of bacteria |
| C. Air | F. None of the Above |
151. Septic tanks use _____ to break down organic material.
- | | |
|--------------------------|----------------------------|
| A. Filamentous organisms | D. Anaerobic bacteria |
| B. Floc particles | E. Biosurfactant trehalose |
| C. Organic material | F. None of the Above |
152. _____ can be hazardous because they release hydrogen sulfide and methane gas.
- | | |
|----------------------------------|---|
| A. Filamentous Bacteria | D. Either anaerobic or aerobic conditions |
| B. Anaerobic bacteria | E. Aerobic bacteria |
| C. Application-specific bacteria | F. None of the Above |
153. Because of _____, hydrogen sulfide or explosive methane gas can accumulate in the collection system and be life-threatening.
- | | |
|-------------------------|----------------------------------|
| A. Anaerobic action | D. Aerobic bacteria |
| B. Free oxygen | E. Application-specific bacteria |
| C. Facultative bacteria | F. None of the Above |

Aerobic Bacteria

154. Aerobic bacteria require free oxygen to live and multiply.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|
155. Facultative bacteria become aerobic when oxygen is present.
- | | |
|---------|----------|
| A. True | B. False |
|---------|----------|
156. Since the metabolism of aerobes is much higher than _____, organic material can be removed with 90% fewer organisms or in 90% less time compared to the anaerobic process.
- | | |
|-------------------------|----------------------------------|
| A. Anaerobic action | D. Aerobic bacteria |
| B. Anaerobes | E. Application-specific bacteria |
| C. Facultative bacteria | F. None of the Above |

Bugs or MOs Section

Paramecium sp.

157. Paramecium is a _____ commonly present in activated sludge. It is medium to large size (100-300 μm).
- | | |
|--------------------|----------------------|
| A. Shelled amoebas | D. Stalked ciliate |
| B. Euglypha | E. Swimming ciliate |
| C. Vorticella | F. None of the Above |
158. Paramecium is _____ over the entire body surface, allowing it to swim with a smooth gliding motion.
- | | |
|-----------------|-----------------------|
| A. Round-shaped | D. Stalked |
| B. Inflexible | E. Uniformly ciliated |
| C. Coiled | F. None of the Above |

159. _____ 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.

160. Vorticella is a _____ found in activated sludge that ranges in length from 30 to 150 μm .
- A. Shelled amoeba
 - B. Euglypha
 - C. Vorticella
 - D. Stalked ciliate
 - E. Paramecium
 - F. None of the Above
161. Characteristics of a Vorticella organism include: oval to round shape; contractile stalk; domed feeding zone; and a water vacuole located near the terminal end of the feeding cavity.
- A. True
 - B. False
162. Except during cell division, one organism is found on each Vorticella stalk
- A. True
 - B. False
163. After reproducing, the offspring of a Vorticella develops swimming cilia and forms its own stalk.
- A. True
 - B. False
164. The organism expelled during the reproduction of a Vorticella is called a _____.
- A. Shelled amoebas
 - B. Euglypha
 - C. Vorticella
 - D. Swarmer
 - E. Paramecium
 - F. None of the Above
165. A bunch of empty _____ indicates poor conditions in an activated sludge system, such as low DO or toxicity.
- A. Shelled amoebas
 - B. Euglypha
 - C. Vorticella stalks
 - D. Stalked ciliates
 - E. Ciliates
 - F. None of the Above

Euglypha sp.

166. Euglypha are _____ with jelly-like bodies and range in size from 70 to 100 μm .
- A. Shelled amoebas
 - B. Euglypha
 - C. Vorticella
 - D. Stalked ciliates
 - E. Paramecium
 - F. None of the Above
167. Euglypha move and feed on bacteria by extending the pseudopodia outward in long, thin, rays.
- A. True
 - B. False
168. Since Euglypha adapt to a wide range of conditions, they are good indicator organisms.
- A. True
 - B. False

Euchlanis sp.

169. Euchlanis is a typical _____. It uses cilia rimmed around its head and a foot with two strong swimming toes for locomotion. It also has a transparent body.
- A. Euglypha
 - B. Shelled amoebas
 - C. Rotifers
 - D. Euchlanis
 - E. Spirochaetes
 - F. None of the Above
170. Euchlanis is _____ that eats detritus, bacteria, and small protozoa.
- A. Euglypha
 - B. Shelled amoeba
 - C. An omnivore
 - D. Euchlanis
 - E. Spirochaetes
 - F. None of the Above
171. The presence of Euchlanis in _____ is evidence that aerobic conditions have been sustained, and that effluent quality is good.
- A. Biofilm
 - B. Plant effluent
 - C. Some bacteria
 - D. Activated sludge
 - E. Wastewater
 - F. None of the Above

Activated Sludge – Organic Load Methods

Organic Load

172. The organic loading from primary treatment processes enters the reactor (aeration basin) where the active microbial population is present.
- A. True
 - B. False
173. 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
174. The treated wastewater leaves the secondary clarifier and is disinfected and discharged. Part of the activated sludge is recycled to the aeration basin.
- A. True
 - B. False
175. 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

176. 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
177. 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

197. Because the suspended particles absorb heat and light, _____ can raise the surface water temperature. Warmer water can hold less dissolved oxygen, which in turn can harm aquatic life.
- A. Oxygen
 - B. High TSS
 - C. Settling sediments
 - D. Hydrogen sulfide
 - E. Suspended sediment
 - F. None of the Above
198. 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
199. _____ can damage the aquatic habitat by filling in spaces between rocks that could have been homes to aquatic organisms.
- A. Oxygen
 - B. Organic material
 - C. Settling sediments
 - D. Hydrogen sulfide
 - E. Suspended sediments
 - F. None of the Above
200. High TSS can often mean higher concentrations of pollutants such as bacteria, nutrients, pesticides, and metals in the water.
- A. True
 - B. False