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

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

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

Collection___Wastewater Treatment ___Pretreatment____ Other _____

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

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

**DISCLAIMER NOTICE**
I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

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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.

## State Approval Listing URL…
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*You can obtain a printed version of the course manual from TLC for an additional $79.95 plus shipping charges.*

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

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

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

## Nutrient Removal Answer Key

**Name**_____

**Phone #**_____

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

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

# NUTRIENT REMOVAL CEU COURSE
## *CUSTOMER SERVICE RESPONSE CARD*

NAME: _____

E-MAIL_____PHONE_____

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

1. Please rate the difficulty of your course.
   Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.
   Very Easy 0 1 2 3 4 5 Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.
   Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course? _____

5. What would you do to improve the Course?

_____

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How about the price of the course?

Poor_____ Fair ____ Average ____ Good____ Great_____

How was your customer service?

Poor___ Fair ____ Average ____ Good _____ Great_____

Any other concerns or comments.

_____

_____

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

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

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

# 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 the exact answer from text.

Natural Systems

1. The natural systems described here include constructed wetlands and floating aquatic plant treatment systems. _____are typically described in terms of the position of the water surface and/or the type of vegetation grown.

A. Aerobic decomposition
B. Wetland systems
C. Subsurface flow (SF)
D. Plant uptake
E. Free water surface (FWS)
F. None of the Above

2. Most natural wetlands are _____ systems where the water surface is exposed to the atmosphere; these include bogs (primary vegetation mosses), swamps (primary vegetation trees), and marshes (primary vegetation grasses and emergent macrophytes).

A. Time
B. SBR(S)
C. Subsurface flow (SF)
D. Plant uptake
E. Free water surface (FWS)
F. None of the Above

3. _____ wetlands are specifically designed to treat or polish wastewater and are typically constructed as a bed or channel containing appropriate media.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow (SF)
D. Plant uptake
E. Free water surface (FWS)
F. None of the Above

4. Constructed wetlands treat wastewater by bacterial decomposition, settling, and filtering. As in tank designs, bacteria break down organic matter in the wastewater,_____.

A. Time
B. SBR(S)
C. Subsurface flow (SF)
D. Aerobically, anoxically and anaerobically
E. Free water surface (FWS)
F. None of the Above

5. Oxygen for _____ is supplied by the plants growing in the wetland.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow (SF)
D. Plant uptake
E. Free water surface (FWS)
F. None of the Above

6. Solids are filtered and _____of the wastewater within the wetland.

A. Aerobic decomposition
B. Finally settle out
C. Subsurface flow or (SF)
D. Plant uptake
E. Free water surface or (FWS)
F. None of the Above

7. After about two weeks in the wetland, effluent is usually discharged by gravity to an unlined wetland bed. If these systems discharge effluent to surface ditches, they require a_____.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow or (SF)
D. Plant uptake
E. NPDES permit
F. None of the Above

8. The submerged plant roots do provide substrate for microbial processes. However, the amount of oxygen that emergent macrophytes can transmit from the leaves to their roots is negligible compared to the _____of wastewater.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow or (SF)
D. Oxygen demand
E. Free water surface or (FWS)
F. None of the Above

9. Subsurface flow wetlands are devoid of oxygen. The lack of oxygen in these subsurface flow systems means that ammonia oxidation via biological nitrification will not occur without the use of an additional unit process, such as a _____for nitrification of the wastewater ammonia.

A. Aerobic decomposition
B. Gravel trickling filter
C. Subsurface flow or (SF)
D. Plant uptake
E. Free water surface or (FWS)
F. None of the Above

10. _____are a modification of subsurface flow wetlands which contain gravel or coarse sand and are loaded intermittently at the top surface.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow or (SF)
D. Vertical flow wetland beds
E. Free water surface or (FWS)
F. None of the Above

11. Unlike ammonia oxidation, nitrate removal in a _____can be rapid and effective because the anoxic conditions and carbon sources necessary to support the treatment reactions occur naturally in these systems.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow wetland
D. Plant uptake
E. Free water surface or (FWS)
F. None of the Above

12. FWS wetlands with long detention times can remove minor amounts of phosphorus through _____, adsorption, complexation, and precipitation.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow or (SF)
D. Plant uptake
E. Free water surface or (FWS)
F. None of the Above

13. Removal via plant uptake is limited to phosphorus retained in plant litter that is buried by sediments before _____occurs (i.e. peat building process).

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow or (SF)
D. Plant decomposition
E. Free water surface or (FWS)
F. None of the Above

14. _____is typically greater in the first year or two because of soil absorption and rapidly expanding vegetation but decreases when the system reaches equilibrium, and unburied plant litter releases phosphorus back into the water as it decomposes.

A. Aerobic decomposition
B. SBR(S)
C. Subsurface flow or (SF)
D. Phosphorus removal
E. Free water surface or (FWS)
F. None of the Above

15. _____ 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 D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

16. Aquatic systems using _____ have been used for a number of years to treat wastewater for various purposes.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

17. _____ are floating macrophytes. Duckweed fronds can double their mass in two days under ideal conditions of nutrient availability, sunlight, and temperature.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

18. Although _____ can be found in most regions, the rate of growth is optimal at 20 to $30^{o}$ C and they grow best in a pH range of 3.5 to 8.5.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

19. _____can grow about six months per year in most U.S. climates. High levels of BOD and TSS removal have been observed from duckweed systems.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

20. To achieve secondary treatment most duckweed systems are coupled with either _____.
A. Phosphorus D. Facultative or aerated ponds
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

21. _____ is removed by plant uptake and harvesting, by denitrification, or a combination of the two.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

22. Typically less than 1 mg/L of _____ can be removed by plant uptake and harvest. If significant phosphorus removal is required, chemical precipitation with alum, ferric chloride, or other chemicals used in a separate treatment step is necessary.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

23. The major disadvantage of _____ systems is the large amount of biomass produced by the rapidly growing plants, which creates a solids handling requirement similar to handling sludge at an aerobic wastewater treatment facility.
A. Phosphorus D. Nitrogen
B. Duckweed (Lemna spp.) E. Chemical addition
C. Denitrification F. None of the Above

Proprietary Filters/Improved and Emerging Technologies

24. A number of companies have developed proprietary _____ and phosphorus removal technologies that can be used at centralized wastewater treatment facilities as well as at onsite, decentralized systems.

A. Phosphorus
B. Pollutant-free urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

25. Recent studies have shown that about 80 percent of the nitrogen and 50 percent of the phosphorus in wastewater are derived from _____ although urine makes up only 1 percent of the volume of wastewater.

A. Phosphorus
B. Urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

26. Separating the urine from wastewater could offer various advantages: WWTPs could be built on a smaller scale, water bodies will be better protected from nitrogen and _____ pollution, nutrients could be recycled for agricultural use, and various constituents of concern including hormones and pharmaceutical compounds could be removed before being mixed with wastewater and released to the environment.

A. Phosphorus
B. Pollutant-free urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

27. A major benefit would be reduced energy consumption at WWTPs as a result of reduced treatment requirements for _____.

A. Phosphorus
B. Pollutant-free urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

28. Separating 50 to 60 percent of _____ could reduce in-plant nitrogen gas discharges and result in fewer impurities in methane captured from sludge digestion.

A. Phosphorus
B. Urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

29. Organizations such as the Swiss Federal Institute of Aquatic Science and Technology are currently experimenting with the development and application of “NoMix technology” to separate _____ from solid waste at the toilet bowl.

A. Phosphorus
B. Urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

30. While similar in size and shape to current toilets, this new technology has two waste pipes – a small front one that collects and diverts _____ into a storage tank, and a larger rear waste pipe that operates like a standard toilet.

A. Phosphorus
B. Urine
C. Solid waste
D. Nitrogen
E. New technology
F. None of the Above

31. The first of these toilets were installed in two “_____” in Sweden in 1994 and since then have spread to other locations throughout the country and to Denmark, the Netherlands, and Switzerland. The concept is now taking hold in Austria and Germany.

A. Phosphorus
B. Pollutant-free urine
C. Solid waste
D. Nitrogen
E. Pharmaceutical compounds
F. None of the Above

32. While the _____, or “urevit,” can be spray-applied directly onto agricultural fields; in the Netherlands, a company called Grontmij trucks stored urine to a special treatment plant where the phosphate is precipitated out as a mineral called struvite and used as a fertilizer.
A. Phosphorus
B. Pollutant-free urine
C. Solid waste
D. Nitrogen
E. New technology
F. None of the Above

33. While studies of consumer attitudes and acceptance appear to be positive, technological improvements are still needed to prevent clogging in pipes, to identify best treatment options that can be applied in practice; and to identify how and where to convert urine to_____.
A. Phosphorus
B. Sustainability
C. Solid waste
D. Nitrogen
E. Fertilizer
F. None of the Above

34. Sustainability concerns are also driving the wastewater treatment industry to start looking at _____as a renewable resource.
A. Phosphorus
B. Sustainability
C. Solid waste
D. Nitrogen
E. Sludge
F. None of the Above

35. Historically, agricultural use has been the traditional approach for disposal of municipal sludge due to its _____for fertilizing crops, and its low cost approach.
A. High nutrient content
B. Sustainability
C. Solid waste
D. Nitrogen
E. Pharmaceuticals
F. None of the Above

36. As scientific advances detect smaller and smaller quantities of contaminants (i.e., heavy metals, _____, pharmaceuticals, and personal care products), the public, farming organizations, and the food industry are raising concerns about continuing this practice.
A. Phosphorus
B. Sustainability
C. Solid waste
D. Pathogenic microorganisms
E. Pharmaceuticals
F. None of the Above

37. Researchers are discovering that valuable products can be generated from sewage treatment byproducts such as energy extracted from anaerobic digestion, construction materials such as bricks, and nutrients such as _____ that can be extracted from sludge and used as fertilizer.
A. Phosphorus
B. Sustainability
C. Solid waste
D. Nitrogen
E. Pharmaceuticals
F. None of the Above

Nutrient Removal for Small Communities and Decentralized Wastewater Treatment Systems

38. Approximately 25 percent of the _____ is served by onsite septic or decentralized systems.
A. Phosphorus
B. Onsite septic
C. Nutrient pollution
D. Alternative sewers
E. Centralized wastewater treatment
F. None of the Above

39. Onsite septic systems treat and dispose of effluent on the same property that produces the wastewater, whereas decentralized treatment refers to onsite or cluster systems that are used to treat and dispose of relatively_____, generally from dwellings and businesses that are located relatively close together.
A. Small volumes of wastewater
B. Onsite septic
C. Nutrient pollution
D. Alternative sewers
E. Centralized wastewater treatment
F. None of the Above

40. In many cases, wastewater from several homes is pretreated onsite by individual septic tanks before being transported through alternative sewers to _____that is relatively simple to operate and maintain.
A. Phosphorus D. An offsite decentralized treatment unit
B. Onsite septic E. Centralized wastewater treatment
C. Nutrient pollution F. None of the Above

41. The remaining 75 percent of the population is served by _____ facilities, which collect and treat large volumes of wastewater.
A. Phosphorus D. Alternative sewers
B. Onsite septic E. Centralized wastewater treatment
C. Nutrient pollution F. None of the Above

42. There is, in fact, a growing movement toward _____to reduce cost, to provide groundwater recharge near the source, and for speed and ease in siting since they are generally located underground.
A. Phosphorus D. Decentralized or clustered wastewater treatment systems
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

43. The use of _____ is gaining in popularity across the U.S. as a means to permanently protect open space, preserve agricultural land, and protect wildlife habitat.
A. Phosphorus D. Flocculation and sedimentation
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

44. As part of these developments, wastewater systems such as community drainfields, irrigation systems, and package plants are being installed to reduce infrastructure investment and _____.
A. Phosphorus D. Minimize adverse environmental impacts
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

45. Additional alternatives that include _____, sand filters, and constructed wetlands can be used to reduce nutrient pollution; particularly in sensitive coastal areas or over sensitive, unconfined aquifers used for drinking water.
A. Phosphorus D. Flocculation and sedimentation
B. Aerobic tanks E. Residential cluster development
C. Nutrient pollution F. None of the Above

Phosphorus Removal
46. Few phosphorus removal processes are well developed for _____systems application.
A. Phosphorus D. Flocculation and sedimentation
B. Onsite wastewater E. Residential cluster development
C. Nutrient pollution F. None of the Above

47. 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_____.
A. Phosphorus D. Flocculation and sedimentation
B. Nitrogen E. Sludge production
C. Nutrient pollution F. None of the Above

48. Most notable successes have come with special filter materials that are naturally high in their_____, but their service lives are finite.
A. Phosphorus D. Concentration of the above chemicals
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

49. Studies of high-iron sands and high-aluminum muds indicate that 50 to 95 percent of the _____ can be removed. However, the life of these systems has yet to be determined, after which the filter media will have to be removed and replaced.
A. Phosphorus D. Flocculation and sedimentation
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

50. Use of supplemental iron powder mixed with natural sands is also being researched. Aside from specialized filter media, the most likely _____-reduction systems are iron-rich intermittent sand filter (ISF) media and SBRs.
A. Phosphorus D. Flocculation and sedimentation
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

Nitrogen Removal
51. Processes that remove 25 to 50 percent of _____include aerobic biological systems and media filters, especially recirculating filters.
A. Phosphorus D. Total nitrogen
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

52. The vast majority of on-site and cluster _____-removal systems employ nitrification and denitrification biological reactions.
A. Phosphorus D. Flocculation and sedimentation
B. Nitrogen E. Residential cluster development
C. Nutrient pollution F. None of the Above

53. Most notable of these are recirculating sand filters (RSFs) with enhanced anoxic modifications, SBRs, and an array of aerobic nitrification processes combined with an _____ to perform denitrification.
A. Phosphorus D. Anoxic/anaerobic process
B. Nitrogen E. Settle out
C. Aerobic nitrification F. None of the Above

54. Some of the combinations are proprietary. A few recently developed highly instrumented systems that utilize membrane solids separation following biological nitrification and denitrification are capable of removing _____down to very low concentrations (i.e. 3 – 4 mg/L TN).
A. Total Dissolved Solids or (TDS) D. Suspended sediment
B. Total solids E. Total nitrogen
C. DO or Dissolved oxygen F. None of the Above

55. Nitrogen removal systems generally are located last in the treatment train prior to subsurface wastewater infiltration system (SWIS) disposal or surface water disposal, in which case a _____is typically required.
A. Phosphorus D. Surface water disposal
B. Nitrogen E. Disinfection step
C. Aerobic nitrification F. None of the Above

56. Usually, the minimum _____standard that can be regularly met is about 10 mg/L. These technologies can be either above ground or below ground.

A. Microorganisms
B. Total nitrogen
C. Waste Sludge
D. Surface water disposal
E. Settle out
F. None of the Above

Secondary Clarification Process

57. The Secondary Clarification process consists of four rectangular tanks which provide quiescent (or calm) conditions which allow the larger aggregates of _____to settle out for collection.

A. Phosphorus
B. Nitrogen
C. Aerobic nitrification
D. Solids and microorganisms
E. Settle out
F. None of the Above

58. The clear overflow (or upper layer) is collected at the end of the tank and passed onto the _____for additional treatment if available.

A. Tertiary process
B. Clear overflow
C. Waste Sludge
D. Surface water disposal
E. Settle out
F. None of the Above

59. The majority of microorganism-rich underflow (or lower layer) is re-circulated to Tanks as Return Sludge to help sustain the microorganism population in the_____.

A. Oxidation Ditches process
B. Clear overflow
C. Waste Sludge
D. Surface water disposal
E. Settle out
F. None of the Above

60. If all the underflow was returned the plant would soon become overloaded with solids, therefore, a small portion of this mixture termed _____ is removed from the system for disposal. The Waste Sludge is transported into the Solids Handing process for disposal.

A. Microorganisms
B. Clear overflow
C. Waste Sludge
D. Surface water disposal
E. Settle out
F. None of the Above

Fixed Film Systems

61. Fixed film systems grow microorganisms on substrates such as rocks, sand or plastic. The wastewater is spread over the substrate, allowing the wastewater to flow past the film of _____ fixed to the substrate.

A. Microorganisms
B. Clear overflow
C. Waste Sludge
D. Surface water disposal
E. Settle out
F. None of the Above

62. As organic matter and nutrients are absorbed from the wastewater, the film of _____ grows and thickens. Trickling filters, rotating biological contactors, and sand filters are examples of fixed film systems.

A. Microorganisms
B. Clear overflow
C. Waste Sludge
D. Surface water disposal
E. Settle out
F. None of the Above

Empty RBC

Suspended Film Systems

63. Suspended film systems stir and suspend microorganisms in wastewater. 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_____.

A. pH
B. Balance of aquatic life
C. Seed
D. Sludge
E. Wastewater characteristics
F. None of the Above

64. Some of the sludge is pumped back into the incoming wastewater to provide "_____" microorganisms.

A. pH
B. Balance of aquatic life
C. Seed
D. Many substances
E. Wastewater characteristics
F. None of the Above

65. The remainder is wasted and sent on to a sludge treatment process. Activated sludge, extended aeration, oxidation ditch, and _____systems are all examples of suspended film systems.

A. Sequential batch reactor
B. Balance of aquatic life
C. Best temperature(s)
D. Renovate sewage
E. Wastewater characteristics
F. None of the Above

Lagoon Systems

66. Lagoon systems are shallow basins which hold the waste-water for several months to allow for the _____of sewage.

A. Natural degradation
B. Balance of aquatic life
C. Seed
D. Many substances
E. Wastewater characteristics
F. None of the Above

67. These systems take advantage of _____in the wastewater to renovate sewage.

A. pH
B. Balance of aquatic life
C. Best temperature(s)
D. Natural aeration and microorganisms
E. Wastewater characteristics
F. None of the Above

Other Important Wastewater Characteristics

68. In addition to the many substances found in wastewater, there are other characteristics system designers and operators use to_____.

A. pH
B. Balance of aquatic life
C. Evaluate wastewater
D. Many substances
E. Wastewater characteristics
F. None of the Above

69. For example, the color, odor, and _____of wastewater give clues about the amount and type of pollutants present and treatment necessary.

A. pH
B. Balance of aquatic life
C. Best temperature(s)
D. Turbidity
E. Wastewater characteristics
F. None of the Above

70. The following are some other important wastewater characteristics that can affect public health and the environment, as well as the design, cost, and_____.

A. pH
B. Balance of aquatic life
C. Best temperature(s)
D. Effectiveness of treatment
E. Wastewater characteristics
F. None of the Above

Temperature

71. The best _____for wastewater treatment probably range from 77 to 95 degrees Fahrenheit.

A. pH
B. Temperatures
C. Seed
D. Many substances
E. Wastewater characteristics
F. None of the Above

72. In general, biological treatment activity accelerates in warm temperatures and slows in cool temperatures, but extreme hot or cold can stop _____altogether.

A. Treatment processes
B. Balance of aquatic life
C. Best temperature(s)
D. Renovate sewage
E. Wastewater characteristics
F. None of the Above

73. Some systems are _____ during cold weather and some may not be appropriate for very cold climates.

A. pH
B. Balance of aquatic life
C. Seed
D. Less effective
E. Wastewater characteristics
F. None of the Above

74. Wastewater temperature also affects receiving waters. Hot water, for example, which is a byproduct of many manufacturing processes, can be a pollutant. When discharged in large quantities, it can raise the _____of receiving streams locally and disrupt the natural balance of aquatic life.

A. pH
B. Balance of aquatic life
C. Best temperature(s)
D. Temperature
E. Wastewater characteristics
F. None of the Above

pH

75. The _____of wastewater affects both treatment and the environment. Low pH indicates increasing acidity while a high pH indicates increasing alkalinity (a pH of 7 is neutral).

A. pH
B. Balance of aquatic life
C. Best temperature(s)
D. Acidity or alkalinity
E. Wastewater characteristics
F. None of the Above

76. The pH of wastewater needs to remain between 6 and 9 to protect organisms. Acids and other substances that alter _____ can inactivate treatment processes when they enter wastewater from industrial or commercial sources.

A. pH
B. Balance of aquatic life
C. Best temperature(s)
D. Renovate sewage
E. Wastewater characteristics
F. None of the Above

Total Dissolved Solids

77. Water is a good solvent and picks up impurities easily. Pure water is tasteless, colorless, and odorless and is often called the_____.

A. pH
B. Total solids
C. DO
D. Universal solvent
E. Total suspended solids and/or total dissolved solids
F. None of the Above

78. _____refer to any minerals, salts, metals, cations or anions dissolved in water.

A. Dissolved solids
B. Total solids
C. DO
D. Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

79. _____comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that are dissolved in water.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total dissolved solids (TDS)
F. None of the Above

80. _____ in drinking-water originate from natural sources, sewage, urban run-off, industrial wastewater, and chemicals used in the water treatment process, and the nature of the piping or hardware used to convey the water, i.e., the plumbing.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total dissolved solids (TDS)
F. None of the Above

81. In general, the _____ concentration is the sum of the cations (positively charged) and anions (negatively charged) ions in the water.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

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

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

83. In addition, the test does not provide us insight into the specific water quality issues, such as: _____, Salty Taste, or Corrosiveness.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

84. The _____ test is used as an indicator test to determine the general quality of the water.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

Total Solids

85. The term "_____" refers to matter suspended or dissolved in water or wastewater, and is related to both specific conductance and turbidity.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

86. _____ (also referred to as total residue) are the term used for material left in a container after evaporation and drying of a water sample.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

87. Total Solids includes both total suspended solids, the portion of total solids retained by a filter and _____, the portion that passes through a filter.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total dissolved solids
F. None of the Above

88. _____ 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. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

89. The increase in weight of the dish represents the total solids. Instead of total solids, laboratories often measure _____.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

Total Suspended Solids (TSS)

90. Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. _____ can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids or (TSS)
F. None of the Above

91. High concentrations of _____ can cause many problems for stream health and aquatic life.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Suspended solids
F. None of the Above

92. High TSS can block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, _____ slows down.

A. pH
B. Total solids
C. DO
D. Elevated Hardness
E. Total suspended solids and/or total dissolved solids
F. None of the Above

93. Reduced rates of _____causes less dissolved oxygen to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Photosynthesis
F. None of the Above

94. As the plants are decomposed, bacteria will use up even more oxygen from the water. Low _____ can lead to fish kills.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

95. _____can also cause an increase in surface water temperature, because the suspended particles absorb heat from sunlight.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. High TSS
F. None of the Above

96. This can cause dissolved oxygen levels to fall even further (because warmer waters can hold less _____), and can harm aquatic life in many other ways, as discussed in the temperature section.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

97. _____ can also clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development. When suspended solids settle to the bottom of a water body, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

98. _____ can fill in spaces between rocks which could have been used by aquatic organisms for homes.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediments
E. Total suspended solids or TSS
F. None of the Above

99. High _____ in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. TSS
F. None of the Above

100. These pollutants may attach to _____on the land and be carried into water bodies with storm water. In the water, the pollutants may be released from the sediment or travel farther downstream.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Sediment particles
E. Total suspended solids or TSS
F. None of the Above

101. High _____ can cause problems for industrial use, because the solids may clog or scour pipes and machinery.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. TSS
F. None of the Above

Measurement of Total Suspended Solids

102. To measure _____, the water sample is filtered through a pre-weighed filter. The residue retained on the filter is dried in an oven at 103 to 105° C until the weight of the filter no longer changes.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

103. The increase in weight of the filter represents the _____. TSS can also be measured by analyzing for total solids and subtracting total dissolved solids.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

104. Total Dissolved Solids (TDS) are solids in water that can pass through a filter (usually with a pore size of 0.45 micrometers). _____is a measure of the amount of material dissolved in water.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

105. This material can include carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and other ions. A certain level of these _____ in water is necessary for aquatic life.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

106. Changes in _____concentrations can be harmful because the density of the water determines the flow of water into and out of an organism's cells.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

107. If _____ concentrations are too high or too low, the growth of many aquatic lives can be limited, and death may occur.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

108. Similar to _____, high concentrations of TDS may also reduce water clarity, contribute to a decrease in photosynthesis, combine with toxic compounds and heavy metals, and lead to an increase in water temperature.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

109. _____is used to estimate the quality of drinking water, because it represents the amount of ions in the water.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

110. Water with high _____ often has a bad taste and/or high water hardness, and could result in a laxative effect.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

111. The TDS concentration of a water sample can be estimated from specific conductance if a linear correlation between the two parameters is first established. Depending on the chemistry of the water, _____ (mg/l) can be estimated by multiplying specific conductance (micromhos/cm) by a factor between 0.55 and 0.75.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

112. _____ can also be determined by measuring individual ions and adding them up.

A. Total Dissolved Solids or (TDS)
B. Total solids
C. DO or Dissolved oxygen
D. Suspended sediment
E. Total suspended solids or TSS
F. None of the Above

Flow

113. Whether a system serves a single home or an entire community, it must be able to handle _____ in the quantity and quality of wastewater it receives to ensure proper treatment is provided at all times.

A. Excess water
B. Fluctuations
C. 3 gallons per person per hour
D. Hydraulically overloaded
E. Cost-effective
F. None of the Above

114. Systems that are _____ or hydraulically overloaded may fail to provide treatment and allow the release of pollutants to the environment.

A. Excess water
B. Ensure proper treatment
C. Inadequately designed
D. Hydraulically overloaded
E. Cost-effective
F. None of the Above

115. To design systems that are both as safe and as _____as possible, engineers must estimate the average and maximum (peak) amount of flows generated by various sources.

A. Excess water
B. Ensure proper treatment
C. 3 gallons per person per hour
D. Hydraulically overloaded
E. Cost-effective
F. None of the Above

116. Because _____ in flow can occur during different times of the day and on different days of the week, estimates are based on observations of the minimum and maximum amounts of water used on an hourly, daily, weekly, and seasonal basis.

A. Excess water
B. Extreme fluctuations
C. 3 gallons per person per hour
D. Hydraulically overloaded
E. Instantaneous peak flow events
F. None of the Above

117. The possibility of _____ that result from several or all water-using appliances or fixtures being used at once also is taken into account.

A. Excess water
B. 45 gallons per person per day
C. 3 gallons per person per hour
D. Hydraulically overloaded
E. Instantaneous peak flow events
F. None of the Above

118. According to studies, water use in many homes is lowest from about midnight to 5 a.m., averaging less than one gallon per person per hour, but then rises sharply in the morning around 6 am to a little over _____.

A. Excess water
B. 45 gallons per person per day
C. 3 gallons per person per hour
D. 35 to 60 gallons or more
E. Complicated task
F. None of the Above

119. During the day, _____off moderately and rises again in the early evening hours. Weekly peak flows may occur in some homes on weekends, especially when all adults work during the week.

A. Excess water
B. 45 gallons per person per day
C. Water use drops
D. 35 to 60 gallons or more
E. Complicated task
F. None of the Above

120. In U.S. homes, average water use is approximately 45 gallons per person per day, but may range from _____.

A. Excess water
B. 45 gallons per person per day
C. 3 gallons per person per hour
D. 35 to 60 gallons or more
E. Complicated task
F. None of the Above

121. Peak flows at stores and other businesses typically occur during business hours and during meal times at restaurants. Rental properties, resorts, and commercial establishments in tourist areas may have _____ seasonally.

A. Excess water
B. 45 gallons per person per day
C. Extreme flow variations
D. 35 to 60 gallons or more
E. Complicated task
F. None of the Above

122. _____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. Estimating flow volumes
B. 45 gallons per person per day
C. 3 gallons per person per hour
D. 35 to 60 gallons or more
E. Complicated task
F. None of the Above

123. Engineers must allow for additional flows during wet weather due to _____of extra water into sewers.

A. Overall characteristics
B. Additional flows
C. Discharged
D. Preliminary screening
E. Inflow and infiltration
F. None of the Above

124. Excess water can enter sewers through leaky manhole covers and cracked pipes and pipe joints, diluting wastewater, which affects its overall characteristics. This can increase flows to treatment plants sometimes by as much as _____the original design load.

A. Overall characteristics
B. Additional flows
C. Three or four times
D. Preliminary screening
E. Self-purification
F. None of the Above

125. The _____ of wastewater treatment plants is to reduce the BOD and COD in the effluent discharged to natural waters, meeting state and federal discharge criteria.

A. Overall characteristics
B. Additional flows
C. Discharged
D. Preliminary screening
E. Main focus
F. None of the Above

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

A. Overall characteristics
B. Additional flows
C. Discharged
D. Microbiology farms
E. Self-purification
F. None of the Above

127. Treatment of wastewater usually involves biological processes such as the activated sludge system in the secondary stage after preliminary screening to remove coarse particles and primary sedimentation that _____.

A. Settles out suspended solids
B. Additional flows
C. Discharged
D. Preliminary screening
E. Self-purification
F. None of the Above

128. These _____ are generally considered environmental biotechnologies that harness natural self-purification processes contained in bioreactors for the biodegradation of organic matter and bioconversion of soluble nutrients in the wastewater.

A. Overall characteristics
B. Additional flows
C. Discharged
D. Preliminary screening
E. Secondary treatment steps
F. None of the Above

Application Specific Microbiology

129. Each wastewater stream is unique, and so too are the community of microorganisms that process it. This "_____" is the preferred methodology in wastewater treatment affecting the efficiency of biological nutrient removal.

A. Oxygen-demanding substances
B. Some contaminants
C. Application specific bacterial cultures
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

130. The right laboratory prepared bugs are more _____ if they have the right growth environment.

A. Oxygen-demanding substances
B. Some contaminants
C. Application specific bacterial cultures
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

131. This efficiency is multiplied if microorganisms are allowed to grow as a layer of biofilm on_____. In this way, optimized biological processing of a waste stream can occur.

A. Oxygen-demanding substances
B. Some contaminants
C. Specifically designed support media
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

132. To reduce the start-up phase for growing a mature biofilm one can also purchase "_____" from appropriate microbiology vendors.

A. Oxygen-demanding substances
B. Some contaminants
C. Application specific bacterial cultures
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

Advanced Methods of Wastewater Treatment

133. As our country and the demand for clean water have grown, it has become more important to produce_____, yet some contaminants are more difficult to remove than others.

A. Oxygen-demanding substances
B. Some contaminants
C. Application specific bacterial cultures
D. Cleaner wastewater effluents
E. Efficient in organics removal
F. None of the Above

134. The demand for cleaner discharges has been met through better and more complete methods of _____at wastewater treatment plants, in addition to pretreatment and pollution prevention which helps limit types of wastes discharged to the sanitary sewer system.

A. Oxygen-demanding substances
B. Some contaminants
C. Removing pollutants
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

135. Currently, nearly all WWTPs provide a_____. In some receiving waters, the discharge of secondary treatment effluent would still degrade water quality and inhibit aquatic life. Further treatment is needed.

A. Oxygen-demanding substances
B. Minimum of secondary treatment
C. Application specific bacterial cultures
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

Advanced Treatment Technologies

136. Treatment levels beyond secondary are called advanced treatment. Advanced treatment technologies can be extensions of _____to further stabilize oxygen-demanding substances in the wastewater, or to remove nitrogen and phosphorus.

A. Oxygen-demanding substances
B. Some contaminants
C. Conventional secondary biological treatment
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

137. Advanced treatment may also involve physical-chemical separation techniques such as adsorption, _____, membranes for advanced filtration, ion exchange, and reverse osmosis.

A. Oxygen-demanding substances
B. Some contaminants
C. Application specific bacterial cultures
D. Flocculation/precipitation
E. Efficient in organics removal
F. None of the Above

138. In various combinations, these processes can achieve any degree of pollution control desired. As wastewater is purified to higher and higher degrees by such advanced treatment processes, the treated effluents can be reused for urban, landscape, and agricultural irrigation, industrial cooling and processing, recreational uses and water recharge, and even indirect_____.

A. Oxygen-demanding substances
B. Augmentation of drinking water supplies
C. Application specific bacterial cultures
D. Application-specific microbiology
E. Efficient in organics removal
F. None of the Above

Nitrogen Control

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

A. Bacteria
B. Nitrification process
C. Phosphorus
D. Ammonia
E. Nitrogen
F. None of the Above

140. If discharged into lakes and streams or estuary waters, nitrogen in the form of _____ can exert a direct demand on oxygen or stimulate the excessive growth of algae.

A. Bacteria
B. Nitrification process
C. Phosphorus
D. Ammonia
E. Nitrogen gas
F. None of the Above

141. Ammonia in wastewater effluent can be toxic to aquatic life in certain instances. By providing additional biological treatment beyond the secondary stage, _____ present in wastewater treatment can biologically convert ammonia to the non-toxic nitrate through a process known as nitrification.

A. Bacteria
B. Nitrifying bacteria
C. Phosphorus
D. Ammonia
E. Nitrogen gas
F. None of the Above

142. The _____is normally sufficient to remove the toxicity associated with ammonia in the effluent.

A. Bacteria
B. Nitrification process
C. Phosphorus
D. Ammonia
E. Nitrogen gas
F. None of the Above

143. Since nitrate is also a nutrient, excess amounts can contribute to the uncontrolled growth of algae. In situations where nitrogen must be completely removed from effluent, additional biological process can be added to the system to convert the _____.
A. Bacteria D. Ammonia
B. Nitrification process E. Nitrate to nitrogen gas
C. Phosphorus F. None of the Above

Conversion of Nitrate to Nitrogen Gas
144. The conversion of _____ is accomplished by bacteria in a process known as denitrification.
A. Nitrate to nitrogen gas D. Ammonia
B. Nitrification process E. Nitrogen gas
C. Phosphorus F. None of the Above

145. Effluent with nitrogen in the form of nitrate is placed into a tank devoid of oxygen, where carbon-containing chemicals, such as methanol, are added or a small stream of raw wastewater is mixed in with the_____.
A. Bacteria D. Nitrified effluent
B. Nitrification process E. Nitrogen gas
C. Phosphorus F. None of the Above

146. In this oxygen free environment, bacteria use the oxygen attached to the nitrogen in the nitrate form, releasing_____.
A. Bacteria D. Ammonia
B. Nitrification process E. Nitrogen gas
C. Phosphorus F. None of the Above

147. Because nitrogen comprises almost 80 percent of the air in the earth's atmosphere, the release of _____ into the atmosphere does not cause any environmental harm.
A. Bacteria D. Ammonia
B. Nitrification process E. Nitrogen
C. Phosphorus F. None of the Above

Biological Phosphorus Control
148. Like nitrogen, _____ is also a necessary nutrient for the growth of algae.
A. Bacteria D. Ammonia
B. Nitrification process E. Nitrogen gas
C. Phosphorus F. None of the Above

149. _____reduction is often needed to prevent excessive algal growth before discharging effluent into lakes, reservoirs and estuaries.
A. Bacteria D. Ammonia
B. Nitrification process E. Nitrogen gas
C. Phosphorus F. None of the Above

150. _____ removal can be achieved through chemical addition and a coagulation-sedimentation process.
A. Bacteria D. Ammonia
B. Nitrification process E. Nitrogen gas
C. Phosphorus F. None of the Above

151. Some biological treatment processes called biological nutrient removal (BNR) can also achieve_____, removing both nitrogen and phosphorus.
A. Bacteria D. Ammonia
B. Nitrification process E. Nutrient reduction
C. Phosphorus F. None of the Above

152. Most of the BNR processes involve modifications of suspended growth treatment systems so that the bacteria in these systems also convert nitrate nitrogen to inert _____ and trap phosphorus in the solids that are removed from the effluent.

A. Bacteria
B. Nitrification process
C. Phosphorus
D. Ammonia
E. Nitrogen gas
F. None of the Above

Coagulation-Sedimentation Process

153. A process known as _____is used to increase the removal of solids from effluent after primary and secondary treatment.

A. Carbon adsorption
B. Floc
C. Larger masses of particles
D. Chemical coagulation-sedimentation
E. Chemical sludge
F. None of the Above

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

A. Carbon adsorption
B. Gravity
C. Larger masses of particles
D. Municipal wastewater
E. Chemical sludge
F. None of the Above

155. Alum, lime, or iron salts are chemicals added to the wastewater to remove phosphorus. With these chemicals, the smaller particles '_____' or clump together into large masses.

A. Carbon adsorption
B. Floc
C. Larger masses of particles
D. Municipal wastewater
E. Chemical sludge
F. None of the Above

156. The larger masses of particles will settle faster when the effluent reaches the next step the sedimentation tank. This process can reduce the concentration of _____by more than 95 percent.

A. Carbon adsorption
B. Floc
C. Larger masses of particles
D. Phosphate
E. Chemical sludge
F. None of the Above

157. Although used for years in the treatment of industrial wastes and in water treatment, _____ is considered an advanced process because it is not routinely applied to the treatment of municipal wastewater.

A. Carbon adsorption
B. Coagulation-sedimentation
C. Larger masses of particles
D. Municipal wastewater
E. Chemical sludge
F. None of the Above

158. In some cases, the process is used as a necessary pretreatment step for other advanced techniques. This process produces a _____, and the cost of disposing of this material can be significant.

A. Carbon adsorption
B. Floc
C. Larger masses of particles
D. Municipal wastewater
E. Chemical sludge
F. None of the Above

Carbon Adsorption

159. Carbon adsorption technology can remove organic materials from wastewater that resist removal by biological treatment. These resistant, trace _____can contribute to taste and odor problems in water, taint fish flesh, and cause foaming and fish kills.

A. Carbon adsorption
B. Floc
C. Organic substances
D. Municipal wastewater
E. Chemical sludge
F. None of the Above

160. Carbon adsorption consists of passing the wastewater effluent through a bed or canister of activated carbon granules or powder which remove more than 98 percent of the trace _____.

A. Carbon adsorption
B. Floc
C. Larger masses of particles
D. Organic substances
E. Chemical sludge
F. None of the Above

161. The substances adhere to the _____and are removed from the water. To help reduce the cost of the procedure, the carbon granules can be cleaned by heating and used again.

A. Carbon surface
B. Floc
C. Larger masses of particles
D. Municipal wastewater
E. Chemical sludge
F. None of the Above

The Use or Disposal of Wastewater Residuals and Biosolids

162. When pollutants are removed from water, there is always something left over. It may be rags and sticks caught on the screens at the beginning of primary treatment. It may be the solids that settle to the bottom of_____.

A. Sedimentation tanks
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

163. The utilization and disposal of the _____is addressed by the CWA, Resource Conservation and Recovery Act (RCRA), and other federal laws.

A. Sewage sludge
B. Biosolids
C. Residual process solids
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

164. These Federal laws re-enforce the need to employ environmentally sound residuals management techniques and to beneficially use _____ whenever possible.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

Processed Wastewater Solids

165. Biosolids are processed wastewater solids ("_____") that meet rigorous standards allowing safe reuse for beneficial purposes.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

166. Currently, more than half of the _____ produced by municipal wastewater treatment systems are applied to land as a soil conditioner or fertilizer and the remaining solids are incinerated or landfilled.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

Biosolids Stabilization

167. Prior to utilization or disposal, _____ are stabilized to control odors and reduce the number of disease-causing organisms.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

168. Sewage solids, or sludge, when separated from the wastewater, still contain around 98 percent water. They are usually thickened and may be dewatered to reduce the volume to be transported for final processing,_____.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Disposal, or beneficial use
E. Undigested sludge solids
F. None of the Above

Dewatering Processes

169. Dewatering processes include drying beds, _____, plate and frame presses, and centrifuges.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Belt filter presses
E. Undigested sludge solids
F. None of the Above

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

A. Larger particles
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

Digestion

171. Digestion is a form of stabilization where the volatile material in the _____can decompose naturally and the potential for odor production is reduced.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Wastewater solids
E. Undigested sludge solids
F. None of the Above

172. Digestion without air in an enclosed tank (anaerobic solids digestion) has the added benefit of producing _____which can be recovered and used as a source of energy.

A. Sewage sludge
B. Biosolids
C. Methane gas
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

173. _____ may also be accomplished by composting, heat treatments, drying or the addition of lime or other alkaline materials. After stabilization, the biosolids can be safely spread on land.

A. Sewage sludge
B. Biosolids
C. Stabilization of solids
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

Land Application

174. In many areas, _____ are marketed to farmers as fertilizer. Federal regulation (40 CFR Part 503) defines minimum requirements for such land application practices, including contaminant limits, field management practices, treatment requirements, monitoring, recordkeeping, and reporting requirements.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

175. Properly treated and applied _____ are a good source of organic matter for improving soil structure and help supply nitrogen, phosphorus, and micronutrients that are required by plants.

A. Sewage sludge
B. Biosolids
C. Stabilization
D. Municipal wastewater
E. Undigested sludge solids
F. None of the Above

176. _____have also been used successfully for many years as a soil conditioner and fertilizer, and for restoring and revegetating areas with poor soils due to construction activities, strip mining or other practices.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

177. Under this _____ management approach, treated solids in semi liquid or dewatered form are transported to the soil treatment areas.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

178. The slurry or dewatered biosolids, containing nutrients and_____, is spread over the land to give nature a hand in returning grass, trees, and flowers to barren land.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilized organic matter F. None of the Above

179. Restoration of the countryside also helps control the flow of acid drainage from mines that endangers fish and other _____and contaminates the water with acid, salts, and excessive quantities of metals.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Aquatic life
C. Stabilization F. None of the Above

Incineration
180. Incineration consists of burning the _____to reduce the organic residuals to an ash that can be disposed of or reused. Incinerators often include heat recovery features.
A. Sewage sludge D. Dried solids
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

181. _____have significant fuel value as a result of their high organic content.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

182. The water content must be greatly reduced by dewatering or drying to take advantage of the fuel potential of the biosolids. For this reason, pressure filtration dewatering equipment is used to obtain _____ which are sufficiently dry to burn without continual reliance on auxiliary fuels. In some cities, biosolids are mixed with refuse or refuse derived fuel prior to burning.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

183. Generally, _____is recovered to provide the greatest amount of energy efficiency.
A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Waste heat F. None of the Above

Beneficial Use Products from Biosolids

184. Heat dried _____ pellets have been produced and used extensively as a fertilizer product for lawn care, turf production, citrus groves, and vegetable production for many years.

A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

185. Composting of _____ is also a well-established approach to solids management that has been adopted by a number of communities.

A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Undigested sludge solids
C. Stabilization F. None of the Above

186. The composted _____has shown particular promise for use in the production of soil additives for revegetation of topsoil depleted areas, and as a potting soil amendment.

A. Sewage sludge D. Municipal wastewater
B. Biosolids E. Peat-like product
C. Stabilization F. None of the Above

187. Effective pretreatment of industrial wastes prevents excessive levels of unwanted constituents, such as _____(i.e. cadmium, mercury, and lead) and persistent organic compounds from contaminating the residuals of wastewater treatment and limiting the potential for beneficial use.

A. Sewage sludge D. Treating wastewater
B. Biosolids E. Heavy metals
C. Stabilization F. None of the Above

188. Effective stabilization of wastewater residuals and their conversion to biosolid products can be costly. Some cities have produced fertilizers from _____ which are sold to help pay part of the cost of treating wastewater.

A. Sewage sludge D. Treating wastewater
B. Biosolids E. Effective pretreatment
C. Stabilization F. None of the Above

189. Some municipalities use composted, heat dried, or lime _____biosolid products on parks and other public areas.

A. Sewage sludge D. Treating wastewater
B. Biosolids E. Effective pretreatment
C. Stabilized F. None of the Above

Decentralized (Onsite and Cluster) Systems

190. A decentralized wastewater system treats sewage from homes and businesses that are not connected to a_____. Decentralized treatment systems include onsite systems and cluster systems.

A. Sewage sludge D. Centralized wastewater treatment plant
B. Biosolids E. Effective pretreatment
C. Stabilization F. None of the Above

191. An onsite system is a wastewater system relying on natural processes, although sometimes containing mechanical components, to collect, treat, disperse or _____from a single dwelling or building. A septic tank and soil adsorption field is an example of an onsite system.

A. Sewage sludge D. Reclaim wastewater
B. Biosolids E. Effective pretreatment
C. Stabilization F. None of the Above

192. A wastewater collection and treatment system under some form of common ownership that collects wastewater from two or more dwellings or buildings and conveys it to a treatment and _____located on a suitable site near the dwellings or buildings is a cluster system.
A. Dispersal system D. Treating wastewater
B. Biosolids E. Effective pretreatment
C. Stabilization F. None of the Above

193. Decentralized systems include those using alternative treatment technologies like media filters, constructed wetland systems, aerobic treatment units, and a variety of soil _____.
A. Sewage sludge D. Treating wastewater
B. Biosolids E. Effective pretreatment
C. Dispersal systems F. None of the Above

194. _____include pressure systems such as low pressure pipe and drip dispersal systems. These systems treat and disperse relatively small volumes of wastewater, and are generally are found in rural and suburban areas.
A. Septic tank(s) D. Soil dispersal systems
B. Septage E. Aerobic treatment units
C. Stabilization F. None of the Above

195. While septic tanks and soil absorption systems have significant limitations, decentralized systems can _____and public health from groundwater and surface water contamination if managed properly (i.e. properly sited, sized, designed, installed, operated, and maintained).
A. Septic tank(s) D. Effectively protect water quality
B. Septage E. Aerobic treatment units
C. Stabilization F. None of the Above

196. _____in groundwater that exceed the drinking water standards can cause health problems.
A. Septic tank(s) D. Treated effluent
B. Septage E. Aerobic treatment units
C. Nitrate concentrations F. None of the Above

Onsite Treatment
197. Onsite wastewater systems contain three components: a treatment unit which treats water prior to dispersal into the environment; a soil dispersal component which assures that treated water is released into the environment at a rate which can be assimilated; and a management system which assures _____of the complete system.
A. Septic tank(s) D. Treated effluent
B. Proper long term operation E. Aerobic treatment units
C. Stabilization F. None of the Above

198. _____of the treated effluent may be provided prior to dispersal. A typical onsite system consists of a septic tank followed by an effluent distribution system.
A. Septic tank(s) D. Treated effluent
B. Septage E. Disinfection
C. Stabilization F. None of the Above

Conventional Septic Tanks
199. A septic tank is a tank buried in the ground used to _____without the presence of oxygen (anaerobic).
A. Septic tank(s) D. Treated effluent
B. Septage E. Aerobic treatment units
C. Treat sewage F. None of the Above

200. The sewage flows from the plumbing in a home or small business establishment into the first of two chambers, where_____.
A. Septic tank(s) D. Treated effluent
B. Septage E. Aerobic treatment units
C. Solids settle out F. None of the Above

201. The liquid then flows into the second chamber. _____in the sewage break down the organic matter, allowing cleaner water to flow out of the second chamber.
A. Septic tank(s) D. Treated effluent
B. Septage E. Aerobic treatment units
C. Anaerobic bacteria F. None of the Above

202. The liquid typically discharges through a subsurface distribution system. Periodically, the _____in the bottom of the tank, referred to as septage, must be removed and disposed of properly.
A. Septic tank(s) D. Treated effluent
B. Solid matter E. Aerobic treatment units
C. Stabilization F. None of the Above

Aerobic Treatment Units
203. Aerobic treatment units are also used to provide_____. They are similar to septic tanks, except that air is introduced and mixed with the wastewater inside the tank.
A. Septic tank(s) D. Onsite wastewater treatment
B. Septage E. Aerobic treatment units
C. Stabilization F. None of the Above

204. Aerobic (requiring oxygen) bacteria consume the organic matter in the sewage. As with the typical septic system, the effluent discharge from an aerobic system is typically released through a _____distribution system or may be disinfected and discharged directly to surface water.
A. Septic tank(s) D. Treated effluent
B. Sub-surface E. Aerobic treatment units
C. Stabilization F. None of the Above

205. _____also require the removal and proper disposal of solids that accumulate in the tank.
A. Septic tank(s) D. Treated effluent
B. Septage E. Aerobic treatment units
C. Stabilization F. None of the Above

Media Filters
206. Media filters are used to provide further treatment of septic tank effluent, and provide high_____. They can be designed to pass the effluent once or multiple times through the media bed. Media, such as sand, acts as a filter.
A. Septic tank(s) D. Levels of nitrification
B. Media E. A mound system
C. Wastewater F. None of the Above

207. The _____ is placed two to three feet deep above a liner of impermeable material such as plastic or concrete.
A. Septic tank(s) D. An absorption field
B. Media E. A mound system
C. Wastewater F. None of the Above

208. Septic tank effluent is applied to the filter surface in intermittent doses and is further treated as it slowly trickles through the _____. In most media filters, wastewater is collected in an underdrain then either pumped back to the filter bed or to other types of treatment.
A. Septic tank(s) D. An absorption field
B. Media E. A mound system
C. Wastewater F. None of the Above

Dispersal Approaches
209. Traditional _____include treatment units followed by a drainfield or absorption field.
A. Septic tank(s) D. An absorption field
B. Onsite systems E. A mound system
C. Wastewater F. None of the Above

210. Wastewater from the treatment unit is dispersed through a suitable soil layer where it receives additional treatment by the soil microorganisms and filtering properties of the soil. If the soil is unsuitable for the installation of a soil absorption field, _____can be used to further treat or distribute the treated effluent.
A. Septic tank(s) D. An absorption field
B. Media E. Alternative methods
C. Wastewater F. None of the Above

211. The most common alternative dispersal systems include low-pressure pipe, _____, drip disposal, and evapotranspiration beds.
A. Septic tank(s) D. An absorption field
B. Media E. Mounds
C. Wastewater F. None of the Above

Absorption Field
212. When soil conditions permit, the most common method to disperse septic tank or aerobic system effluent is _____ consisting of a series of perforated parallel pipes laid in trenches on gravel or crushed stone or as a direct discharge to the soil through trenches.
A. Septic tank(s) D. An absorption field
B. Media E. A mound system
C. Wastewater F. None of the Above

213. Typically, effluent flows into the absorption field from a _____which maintains an even flow of effluent to the absorption field. From there, the effluent drains through the stone and into the soil which provides further treatment.
A. Septic tank(s) D. An absorption field
B. Distribution box E. A mound system
C. Wastewater F. None of the Above

Biological Criteria
214. A water body in its natural condition is free from the harmful effects of pollution, habitat loss, and other negative stressors. It is characterized by a particular _____and abundance of organisms.
A. Food chain D. Mixed, complex and interrelated
B. Biological diversity E. Stabilization of organic wastes
C. Water bodies or Various bodies of water F. None of the Above

215. This biological integrity--or natural structure and function of aquatic life--can be dramatically different in various types of water bodies in different parts of the country. Because of this, the EPA is developing methodologies that states can use to assess the _____of their waters and, in so doing, set protective water quality standards.

A. Food chain
B. Sediment-dwelling organisms
C. Water bodies or Various bodies of water
D. Mixed, complex and interrelated
E. Biological integrity
F. None of the Above

216. These methodologies will describe scientific methods for determining a particular aquatic community's health and for maintaining _____in various bodies of water.

A. Optimal conditions
B. Sediment-dwelling organisms
C. Water bodies or Various bodies of water
D. Mixed, complex and interrelated
E. Stabilization of organic wastes
F. None of the Above

Summary

217. The goal of all biological wastewater treatment systems is to remove the _____and the dissolved organic load from the effluents by using microbial populations.

A. Microbial populations
B. Non-settling solids
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

218. _____are generally part of secondary treatment systems.

A. Microbial populations
B. Non-biodegradable portion
C. Biological treatments
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

219. The microorganisms used are responsible for the _____of the organic matter and the stabilization of organic wastes.

A. Degradation
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

220. With regard to the way in which they utilize oxygen, they can be classified into aerobic (require oxygen for their metabolism), anaerobic (grow in absence of oxygen) and facultative (can proliferate either in absence or presence of oxygen although using_____).

A. Microbial populations
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Different metabolic processes
F. None of the Above

221. Most of the micro-organisms present in wastewater treatment systems use the organic content of the wastewater as an energy source to grow, and are thus classified as heterotrophes from a_____.

A. Microbial populations
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Nutritional point of view
E. Attached growth processes
F. None of the Above

222. The population active in a biological wastewater treatment _____.

A. Microbial populations
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

223. In a well-functioning system, _____are usually present and are useful in consuming dispersed bacteria or non-settling particles. More extensive description and treatment of the microbiology of wastewater treatment systems are given elsewhere.

A. Microbial populations
B. Protozoas and rotifers
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

224. The organic load present is incorporated in part as biomass by the microbial populations, and almost all the rest is liberated as gas (carbon dioxide (CO2) if the treatment is aerobic, or carbon dioxide plus methane (CH4) if the process is anaerobic) and water. In fisheries wastewaters the _____ is very low.

A. Microbial populations
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

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

A. Microbial populations
B. Non-biodegradable portion
C. Biological treatment
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

226. The biological treatment processes used for wastewater treatment are broadly classified as aerobic in which aerobic and _____ predominate or anaerobic which use anaerobic micro-organism.

A. Microbial populations
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Attached growth processes
F. None of the Above

227. If the microorganisms or Bugs are suspended in the wastewater during biological operation, the operations are "_____", while the micro-organisms that are attached to a surface over which they grow are called "attached growth processes".

A. Microbial populations
B. Non-biodegradable portion
C. Facultative micro-organisms
D. Mixed, complex and interrelated
E. Called suspended growth processes
F. None of the Above

F/M and MCRT

228. The following are some general statements about _____assuming that the environmental conditions are properly controlled.

A. Rotifers
B. Stalked ciliates
C. Gliding ciliates
D. F/M and MCRT
E. New sludge
F. None of the Above

229. The optimum operating point of either helps obtain the_____.

A. Rotifers
B. Stalked ciliates
C. Gliding ciliates
D. Best effluent and sludge quality
E. Desired effluent concentration
F. None of the Above

230. Both provide a means for maintaining the _____.

A. Rotifers
B. Stalked ciliates
C. Gliding ciliates
D. Best effluent and sludge quality
E. New sludge
F. None of the Above

231. Both techniques attempt to regulate rate of growth, metabolism, and stabilization_____.
A. Rotifers D. Best effluent and sludge quality
B. Stalked ciliates E. New sludge
C. Gliding ciliates F. None of the Above

232. Both techniques indicate the solids level needed to _____and attain sludge quality.
A. Rotifers D. Stabilize the food
B. Stalked ciliates E. New sludge
C. Gliding ciliates F. None of the Above

233. The operating control point is that point when the best effluent and _____is obtained for the existing conditions.
A. Rotifers D. Sludge quality
B. Stalked ciliates E. New sludge
C. Gliding ciliates F. None of the Above

Microorganisms in Lagoons
234. Swimming and _____ engulf bacteria or other prey.
A. Rotifers D. Best effluent and sludge quality
B. Stalked ciliates E. New sludge
C. Gliding ciliates F. None of the Above

235. Stalked ciliates attach to the biomass and _____into their gullets, while crawlers break bacteria loose from the floc surface.
A. Vortex suspended bacteria D. Best effluent and sludge quality
B. Stalked ciliates E. New sludge
C. Gliding ciliates F. None of the Above

236. Predators feed mostly on stalked and_____. The omnivores, such as most rotifers, eat whatever is readily available, while the worms feed on the floc or prey on larger organisms. Microorganisms are directly affected by their treatment environment.
A. Rotifers D. Best effluent and sludge quality
B. Swimming ciliates E. New sludge
C. Gliding ciliates F. None of the Above

237. Changes in food, dissolved oxygen, temperature, pH, _____, sludge age, presence of toxins, and other factors create a dynamic environment for the treatment organisms.
A. Rotifers D. Best effluent and sludge quality
B. Stalked ciliates E. Total dissolved solids
C. Gliding ciliates F. None of the Above

238. Food (organic loading) regulates_____, diversity, and species when other factors are not limiting. The relative abundance and occurrence of organisms at different loadings can reveal why some organisms are present in large numbers while others are absent.
A. Degrade BOD D. Microorganism numbers
B. Oxidize BOD E. Wide range in environmental tolerance
C. High organic loading F. None of the Above

Aerobic Bacteria

239. The aerobic bacteria that occur are similar to those found in other treatment processes such as activated sludge. Three functional groups occur:_____, single bacteria; floc-forming bacteria; and filamentous bacteria. All function similarly to oxidize organic carbon (BOD) to produce CO2 and new bacteria (new sludge).

A. Degrade BOD
B. Freely dispersed
C. High organic loading
D. Regulates microorganism numbers
E. Wide range in environmental tolerance
F. None of the Above

240. Many bacterial species that degrade wastes grow as single bacteria dispersed in the wastewater. Although these readily _____, they do not settle and hence often leave the system in the effluent as solids (TSS).

A. Degrade BOD
B. Oxidize BOD
C. High organic loading
D. Regulates microorganism numbers
E. Wide range in environmental tolerance
F. None of the Above

Nitrification

241. It was once thought that only two bacteria were involved in nitrification: Nitrosomonas europaea, which_____, and Nitrobacter winogradskyi, which oxidizes nitrite to nitrate.

A. Nitrifying bacteria
B. Bacteria oxidize ammonia
C. Reduced biological activity
D. Non-biodegradable fraction
E. Oxidizes ammonia to nitrite
F. None of the Above

242. It is now known that at least 5 genera of bacteria oxidize ammonia and at least three genera of_____.

A. Nitrifying bacteria
B. Bacteria oxidize ammonia
C. Bacteria oxidize nitrite
D. Non-biodegradable fraction
E. Oxidizes nitrite to nitrate
F. None of the Above

243. Besides oxygen, these nitrifying bacteria require a neutral pH (7-8) and substantial alkalinity (these autotrophs use CO2 as a carbon source for growth). This indicates that complete _____would be expected at pond pH values between pH 7.0 and 8.5.

A. Nitrifying bacteria
B. Nitrification
C. Reduced biological activity
D. Non-biodegradable fraction
E. Oxidizes nitrite to nitrate
F. None of the Above

244. Nitrification ceases at pH values above pH 9 and declines markedly at pH values below 7. This results from the growth inhibition of the _____.

A. Nitrifying bacteria
B. Bacteria oxidize ammonia
C. Reduced biological activity
D. Non-biodegradable fraction
E. Oxidizes nitrite to nitrate
F. None of the Above

245. Nitrification, is not a major pathway for nitrogen removal in lagoons. _____ exists in low numbers in lagoons. They prefer attached growth systems and/or high MLSS sludge systems.

A. Nitrifying bacteria
B. Bacteria oxidize ammonia
C. Reduced biological activity
D. Non-biodegradable fraction
E. Oxidizes nitrite to nitrate
F. None of the Above

Anaerobic Bacteria

246. Anaerobic, heterotrophic bacteria that commonly occur in lagoons are involved in methane formation (acid-forming and methane bacteria) and in _____(sulfate reducing bacteria).

A. An anaerobic fermenter
B. Sulfate reduction
C. Methane bacteria
D. General anaerobic degraders
E. Anaerobic methane formation
F. None of the Above

247. _____ involves three different groups of anaerobic bacteria that function together to convert organic materials to methane via a three-step process.

A. An anaerobic fermenter
B. Acid formers
C. Methane bacteria
D. General anaerobic degraders
E. Anaerobic methane formation
F. None of the Above

248. _____ - many genera of anaerobic bacteria hydrolyze proteins, fats, and poly saccharides present in wastewater to amino acids, short-chain peptides, fatty acids, glycerol, and mono- and di-saccharides. These have a wide environmental tolerance in pH and temperature.

A. An anaerobic fermenter
B. Acid formers
C. Methane bacteria
D. General anaerobic degraders
E. Anaerobic methane formation
F. None of the Above

Photosynthetic Organisms

249. _____- this diverse group of bacteria converts products from above under anaerobic conditions to simple alcohols and organic acids such as acetic, propionic, and butyric. These bacteria are hardy and occur over a wide pH and temperature range.

A. An anaerobic fermenter
B. Acid-forming bacteria
C. Methane bacteria
D. General anaerobic degraders
E. Anaerobic methane formation
F. None of the Above

250. _____- these bacteria convert formic acid, methanol, methylamine, and acetic acid under anaerobic conditions to methane.

A. An anaerobic fermenter
B. Acid formers
C. Methane forming bacteria
D. General anaerobic degraders
E. Anaerobic methane formation
F. None of the Above

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