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Tertiary Treatment Answer Key

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

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The Assignment is available in Word on the Internet for your Convenience, please visit www.ABCTLTC.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. 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.

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

Basic Wastewater Treatment Processes

1. *Physical processes* were some of the earliest methods to remove solids from wastewater, usually by passing wastewater through screens to remove debris and solids. In addition, solids that are heavier than water will settle out from wastewater by gravity.

A. True B. False

2. In wastewater treatment, particles with which of the following terms will float to the top of water and can also be removed?

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

Biological

3. Bacteria and other small organisms in water will consume organic matter in sewage, turning it into new bacterial cells, _____, and other by-products.

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

4. To remove organic material from wastewater, Scientists observed that _____ could be contained and accelerated in systems.

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

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

A. True B. False

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

A. True B. False

7. Which of the following wastewater terms means - is a suspended growth process for removing organic matter from sewage by saturating it with air and microorganisms that can break down the organic matter?

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

8. Masses of microorganisms grow and rapidly metabolized organic pollutants because of the addition of _____ to wastewater.

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

Chemical

9. Which of the following wastewater terms such as alum, lime or iron salts can be added to wastewater to cause certain pollutants, to floc or bunch together into large, heavier masses which can be removed faster through physical processes?

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

10. The chemical industry has developed _____ known as polymers to further improve the physical separation step in wastewater treatment.

- A. Oxygen
- B. Carbon dioxide
- C. Gravity
- D. Secondary treatment
- E. Synthetic inert chemicals
- F. None of the Above

11. Which of the following wastewater terms are often used at the later stages of treatment to improve the settling of excess microbiological growth or biosolids?

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

12. According to the text, chemicals can be used to create changes in pollutants that increase the removal of these new forms by physical processes.

- A. True
- B. False

Oil and Grease

13. Fatty organic materials from animals, vegetables, and petroleum are quickly broken down by bacteria and can cause pollution in receiving environments.

- A. True
- B. False

14. Which of the following wastewater terms also adds to the septic tank scum layer, causing more frequent tank pumping to be required?

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

Inorganics

15. Which of the following wastewater terms are relatively stable, and cannot be broken down easily by organisms in wastewater?

- A. Metals
- B. Most inorganic substances
- C. Nitrogen and phosphorus
- D. Pesticides and herbicide(s)
- E. Petroleum-based waste oil(s)
- F. None of the Above

16. Extra treatment steps are often required to remove _____ from industrial wastewater sources.

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. BOD
- E. DON
- F. None of the Above

17. According to the text, heavy metals can be discharged with many types of industrial wastewaters are difficult to remove by conventional treatment methods.

- A. True
- b. False

18. Which of the following wastewater terms - metals, and compounds, such as sodium, potassium, calcium, magnesium, cadmium, copper, lead, nickel, and zinc are common in wastewater from both residential and nonresidential sources?

- A. Nutrients from wastewater
- B. Inorganic materials
- C. Inorganic minerals
- D. Excessive grease
- E. Pesticides and herbicide(s)
- F. None of the Above

Nutrients

19. Normally, excessive nutrients in receiving waters cause algae and other plants to grow quickly adding oxygen in the water, because of this additional of oxygen, fish and other aquatic life thrive.

- A. True
- B. False

Solids

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

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

Gases

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

- A. True
- B. False

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

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

Hydrogen Sulfide and Ammonia

23. The gases hydrogen sulfide and along with _____ can be toxic and pose asphyxiation hazards.

- A. Ammonia
- B. Wastewater odor(s)
- C. Hydrogen sulfide or H₂S problem(s)
- D. The lack of oxygen
- E. Less oxygen
- F. None of the Above

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

- A. True
- B. False

Pollutants, Oxygen-Demanding Substances

25. Which of the following terms is a key element in water quality that is necessary to support aquatic life?

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

Pathogens

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

- A. True
- B. False

Nutrients

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

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

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

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

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

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

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

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

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

- A. True
- B. False

Inorganic and Synthetic Organic Chemicals

32. Inorganic and Synthetic Organic Chemicals can cause _____ problems, and many are not effectively removed by conventional wastewater treatment.
- A. Toxic
 - B. Ecology
 - C. Nutrient enrichment
 - D. Excessive growth of algae
 - E. Taste and odor
 - F. None of the Above

Thermal

33. Which of the following terms reduces the capacity of water to retain oxygen?
- A. Heat
 - B. Heavy metals
 - C. Nutrient enrichment
 - D. Excessive growth of algae
 - E. Phosphorus and nitrogen
 - F. None of the Above

Primary Treatment

34. There are two basic stages in the treatment of wastes, RAS and WAS.
- A. True
 - B. False

Preliminary Treatment

35. The Preliminary Treatment is purely physical stage consisting of Coarse Screening, Raw Influent Pumping, Static Fine Screening, Grit Removal, and Selector Tanks.
- A. True
 - B. False

36. Which of the following terms enters from the collection system into the Coarse Screening process?
- A. Solid(s)
 - B. Finer debris
 - C. Grit and gravel
 - D. Raw wastewater
 - E. Dissolved organic and inorganic constituents
 - F. None of the Above

37. After the wastewater has been screened, it may flow into a grit chamber where sand, grit, cinders, and small stones settle to the bottom
- A. True
 - B. False

38. Especially in cities with combined sewer systems, removing the _____ that washes off streets or land during storms is very important.
- A. Very fine solids
 - B. Grit and gravel
 - C. Pollutant(s)
 - D. Primary sludge
 - E. Grit and screenings
 - F. None of the Above

39. Large amounts of _____ entering a treatment plant can cause serious operating problems, such as excessive wear of pumps and other equipment.
- A. Solid(s)
 - B. Finer debris
 - C. Grit and gravel
 - D. Grit and sand
 - E. Dissolved organic and inorganic constituents
 - F. None of the Above

40. In some plants, another finer screen is placed after the grit chamber to remove any additional material that might damage equipment or interfere with later processes.
- A. True
 - B. False

41. Which of the following terms then passes into the Static Fine Screening process which consists of two stationary screens?

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Flow
- E. Dissolved organic and inorganic constituents
- F. None of the Above

42. The wastewater passes into _____ process which consists of two vortex grit separators which produce a whirlpool action to force the finest debris to the outside perimeter.

- A. Very fine solids
- B. De-gritted wastewater
- C. Grit Removal
- D. Primary sludge
- E. Grit and screenings
- F. None of the Above

43. Which of the following terms removed by these processes must be periodically collected and trucked to a landfill for disposal or are incinerated?

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

44. The Coarse Screening consists of a basket shaped bar screen which collects larger debris (several inches in diameter) prior to the Raw Influent Pumping.

- A. True
- B. False

45. Which of the following terms is removed and placed into a dumpster for disposal into the landfill?

- A. Liquids
- B. Finer debris
- C. Compounds
- D. Debris
- E. Dissolved organic and inorganic constituents
- F. None of the Above

46. Which of the following terms passes into the Raw Influent Pumping process that consists of submersible centrifugal pumps?

- A. Wastewater
- B. Split samples
- C. Duplicate samples
- D. Dissolved organic and inorganic constituents
- E. Grit and gravel
- F. None of the Above

Primary Sedimentation

47. Pollutants that are dissolved or are very fine and remain suspended in the wastewater are easily removed effectively by gravity settling.

- A. True
- B. False

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

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

49. When the screening completed and the grit removed, wastewater is clear of dissolved organic and inorganic constituents along with suspended solids.

- A. True
- B. False

50. Which of the following wastewater treatment terms consist of minute particles of matter that can be removed from the wastewater with further treatment such as sedimentation or gravity settling, chemical coagulation, or filtration?
- A. Solid(s)
 - B. Suspended solids
 - C. Grit and gravel
 - D. Suspended growth process(es)
 - E. Dissolved organic and inorganic constituents
 - F. None of the Above

Secondary Treatment

51. Which of the following wastewater treatment terms has been through Primary Treatment processes, it flows into the next stage of treatment called secondary?

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

52. The two most common conventional methods used to achieve secondary treatment are: which of the following term and suspended growth processes.

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

53. The Secondary Treatment stage consists of a biological process such as _____ and a physical process, Secondary Clarification.

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

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

- A. Solid(s)
- B. Finer debris
- C. Grit and gravel
- D. Suspended growth process(es)
- E. Dissolved organic and inorganic constituents
- F. None of the Above

Nitrogen and Phosphorus Removal Technologies

55. Small system owners and operators should work closely with their program staff as well as engineers to ensure that the technologies selected will work effectively in combination to achieve the goals related to?

- A. Effluent
- B. Oxidation
- C. Optimal DO levels
- D. Trickling filter FFSs
- E. A portion of the denitrified effluent
- F. None of the Above

Nutrient Removal Technologies

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

56. Which of the following terms are biological treatment processes that employ a medium such as rock, plastic, wood, or other natural or synthetic solid material that will support biomass on its surface?

- A. Trickling filter(s)
- B. Fixed-film systems (FFSs)
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

57. Which of the following terms are typically constructed as beds of media through which wastewater flows?

- A. A closed loop
- B. Nitrogen removal system(s)
- C. Optimal DO levels
- D. Trickling filter FFSs
- E. A portion of the denitrified effluent
- F. None of the Above

58. Which of the following terms represents removal typically varies from 0 to 35 percent although removal percentages as high as 65%?

- A. Nitrified effluent
- B. Nitrogen
- C. Total Nitrogen (TN)
- D. Nitrogen and phosphorus levels
- E. Activated sludge
- F. None of the Above

59. Phosphorus removal is typically 1 to 1.5 percent.

- A. True
- B. False

60. Multi-pass systems result in higher treatment quality and assist in removing _____ levels by promoting nitrification in the aerobic media bed and denitrification in the anaerobic septic tank.

- A. Total Solids
- B. TDS
- C. pH
- D. Elevated Hardness, Salty Taste, or Corrosiveness
- E. Total Nitrogen (TN)
- F. None of the Above

61. According to the text, some of the factors affecting performance include influent wastewater characteristics, hydraulic and organic loading, medium type, maintenance of optimal DO levels, and?

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

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

- A. True
- B. False

63. Which of the following terms returns to the anoxic zone to mix with either septic tank contents or incoming septic tank effluent for denitrification?

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

Sequencing batch reactor (SBR)

64. According to the text, the SBR process is a sequential suspended growth process in which all major steps occur in the same tank in sequential order.

- A. True
- B. False

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

- A. SBR process
- B. Underdrain system
- C. Sand filter(s)
- D. Cluster applications
- E. Process control timer(s)
- F. None of the Above

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

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. SBRs
- E. Recirculating sand filters (RSFs)
- F. None of the Above

67. Which of the following terms are suitable for areas with little land, stringent treatment requirements, and small wastewater flows such as RV parks, and other small applications?

- A. Package plant SBRs
- B. Sand filter(s)
- C. Chemical adsorption
- D. Fixed-film bioreactor(s)
- E. Diffused air or mechanical devices
- F. None of the Above

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

- A. Decanter
- B. Underdrain system
- C. Sand filter(s)
- D. Cluster applications
- E. Process control timer(s)
- F. None of the Above

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

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. SBRs
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

70. Several decanter configurations are available, including?

- A. Fixed and floating units
- B. Recirculating filter(s)
- C. Available adsorption sites
- D. Septic tank effluent
- E. Distribution network
- F. None of the Above

Natural Systems

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

- A. True
- B. False

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

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

73. Which of the following terms is typically greater in the first year or two because of soil absorption?

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

74. Which of the following terms is also possible with the use of an addition process, such as chemical addition and mixing prior to a final deep settling pond?

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

75. Subsurface flow (SF) wetlands are specifically designed to treat or polish _____ and are typically constructed as a bed or channel containing appropriate media.

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. Wastewater
- E. Oxygen demand of wastewater
- F. None of the Above

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

- A. True
- B. False

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

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. Wetlands
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

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

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

79. The wetland's effluent after two weeks is usually discharged by gravity to an unlined wetland bed, if these systems discharge effluent to oxidation ditches, they do not require a NPDES permit.

- A. True
- B. False

80. Solids are filtered and finally settle out of the wastewater within the?

- A. Underdrain system
- B. Free water surface (FWS) systems
- C. Wetland
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

81. The emergent macrophytes can transmit the amount of oxygen from the leaves to their roots is negligible compared to the oxygen demand of wastewater, therefore _____ are devoid of oxygen.

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

82. Which of the following terms are a modification of subsurface flow wetlands which contain gravel or coarse sand and are loaded intermittently at the top surface?

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Vertical flow wetland beds
- E. Recirculating sand filters (RSFs)
- F. None of the Above

83. Which of the following terms in a subsurface flow wetland can be rapid and effective because the anoxic conditions and carbon sources?

- A. Wastewater temperature
- B. Phosphorus removal
- C. Nitrate removal
- D. An aerobic wastewater treatment facility
- E. Oxygen demand of wastewater
- F. None of the Above

84. Which of the following terms have been used for a number of years to treat wastewater for various purposes?

- A. Duckweed
- B. Free water surface (FWS) systems
- C. Oxygen
- D. Conventional recirculation tank
- E. Anaerobic septic tank effluent
- F. None of the Above

85. Nitrogen is removed by plant uptake and?

- A. Filamentous organisms
- B. Floc particles
- C. Organic material
- D. Harvesting, by denitrification
- E. Biosurfactant trehalose
- F. None of the Above

86. A disadvantage of duckweed systems is the large amount of biomass produced by the rapidly growing plants, which creates a _____ requirement.

- A. Ammonia oxidation
- B. Phosphorus removal
- C. Nitrate removal
- D. Solids handling
- E. Oxygen demand of wastewater
- F. None of the Above

Secondary Clarification Process

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

- A. True
- B. False

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

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

Fixed Film Systems

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

- A. Mature biofilm
- B. Activated sludge system
- C. Advanced treatment technologies
- D. Application-specific microbiology
- E. Fixed film systems
- F. None of the Above

90. The wastewater is spread over the substrate, allowing the wastewater to flow past the film of microorganisms fixed to the substrate.

- A. True
- B. False

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

- A. Trickling filter(s)
- B. Oxidation Ditches
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

Suspended Film Systems

92. As the microorganisms absorb organic matter and nutrients from the wastewater, they grow in size and number. After the microorganisms have been suspended in the wastewater for several hours, they are settled out as sludge.

- A. True
- B. False

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

- A. Nitrogen removal system(s)
- B. Tertiary process
- C. Microorganism(s)
- D. Suspended film system(s)
- E. Recirculating sand filters (RSFs)
- F. None of the Above

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

- A. Trickling filter(s)
- B. Extended aeration
- C. Nitrogen removal system(s)
- D. Aerobic nitrification processes
- E. Recirculating sand filters (RSFs)
- F. None of the Above

Other Important Wastewater Characteristics

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

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

Temperature

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

- A. True
- B. False

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

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Total Suspended Solids (TSS)
- E. Extreme hot or cold
- F. None of the Above

98. Hot water is a byproduct of many manufacturing processes and is not a pollutant. When discharged in large quantities, it can raise the temperature of receiving streams improving the natural balance of aquatic life.

- A. True
- B. False

pH

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

- A. True
- B. False

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

- A. True
- B. False

101. Which of the following terms of wastewater needs to remain between 6 and 9 to protect organism?

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

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

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

Total Dissolved Solids

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

- A. True
- B. False

104. Which of the following wastewater terms is a good solvent and picks up impurities easily?

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

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

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

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

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

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

- A. True
- B. False

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

- A. True
- B. False

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

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

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

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

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

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

Total Solids

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

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

113. Which of the following wastewater terms are the term used for material left inside a container after evaporation and drying of a water sample?

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

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

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

115. Which of the following wastewater terms can be measured by evaporating a water sample in a weighed dish, and then drying the residue in an oven at 103 to 105° C?

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

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

- A. True
- B. False

Total Suspended Solids (TSS)

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

- A. True
- B. False

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

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

119. Which of the following wastewater terms can block light from reaching submerged vegetation?

- A. Total Solids
- B. TDS
- C. pH
- D. Total Suspended Solids (TSS)
- E. High TSS
- F. None of the Above

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

A. True B. False

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

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Total Suspended Solids (TSS)
- E. Suspended sediment
- F. None of the Above

122. When suspended solids settle to the bottom of a water body, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae.

A. True B. False

123. Which of the following wastewater terms – can fill in spaces between rocks which could have been used by aquatic organisms for homes?

- A. Oxygen
- B. High TSS
- C. Settling sediments
- D. Total Suspended Solids (TSS)
- E. Suspended sediment
- F. None of the Above

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

A. True B. False

125. Estimating _____ for centralized treatment systems is a complicated task, especially when designing a new treatment plant in a community where one has never existed previously.

- A. Peak flow(s)
- B. Flow volume(s)
- C. Additional flows
- D. This can increase flow(s)
- E. Original design load
- F. None of the Above

126. Engineers must allow for _____ during wet weather due to inflow and infiltration of extra water into sewers.

- A. Peak flow(s)
- B. Flow volume(s)
- C. Additional flows
- D. This can increase flow(s)
- E. Original design load
- F. None of the Above

Application Specific Microbiology

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

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

128. Laboratory prepared bugs are more efficient in organics removal if they have the right growth environment, this efficiency is multiplied if microorganisms are allowed to grow.

A. True B. False

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

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

Advanced Methods of Wastewater Treatment

130. As our country and the demand for clean water have grown, it has become more important to produce cleaner wastewater effluents, yet _____ are more difficult to remove than others.

- A. Biofilm
- B. Some contaminants
- C. Secondary treatment effluent
- D. Soluble nutrients
- E. Oxygen and organic waste
- F. None of the Above

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

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

132. All WWTPs provide a minimum of?

- A. Biofilm
- B. Secondary treatment
- C. Secondary treatment effluent
- D. Pretreatment and pollution prevention
- E. Oxygen and organic waste
- F. None of the Above

Nitrogen Control

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. Nitrification
- B. Ammonia
- C. Nitrogen
- D. Nitrogen in the nitrate form
- E. Ammonia to the non-toxic nitrate
- F. None of the Above

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

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

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

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

Conversion of Nitrate to Nitrogen Gas

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

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

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

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

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

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

Biological Phosphorus Control

141. Like nitrogen, phosphorus is also a necessary nutrient for the growth of algae.

- A. True B. False

142. Which of the following wastewater treatment terms - removal can be achieved through chemical addition and a coagulation-sedimentation process?

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

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

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

144. BNR processes involve modifications of suspended growth treatment systems in that the bacteria in these systems also convert this compound to inert nitrogen gas.

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

Coagulation-Sedimentation Process

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

- A. True B. False

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

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

147. Which of the following wastewater treatment terms can be added to the wastewater to remove phosphorus?

- A. Other alkaline materials
- B. A form of stabilization
- C. Sewage solids, or sludge
- D. Alum, lime, or iron salts are chemicals
- E. Phosphate
- F. None of the Above

148. Which of the following wastewater treatment terms -is considered an advanced process because it is not routinely applied to the treatment of municipal wastewater?

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

Carbon Adsorption

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

- A. Denitrification process
- B. Biological treatment
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Anaerobic sludge
- F. None of the Above

150. Which of the following wastewater treatment terms - consists of passing the wastewater effluent through of activated carbon granules or powder?

- A. Carbon adsorption
- B. An advanced process
- C. Carbonic dioxide
- D. A form of stabilization
- E. Super treatment
- F. None of the Above

Processed Wastewater Solids

151. Which of the following wastewater treatment terms - are considered biosolids and need to meet rigorous standards allowing safe reuse for beneficial purposes?

- A. Other alkaline materials
- B. A form of stabilization
- C. Sewage solids, or sludge
- D. Processed wastewater solids
- E. Rags and sticks
- F. None of the Above

Biosolids Stabilization

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

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

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

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

Dewatering Processes

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

- A. True
- B. False

155. Which of the following wastewater treatment terms - include drying beds, belt filter presses, plate and frame presses, and centrifuges?

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

Digestion

156. Digestion is a form of _____ where the volatile material can decompose naturally and the potential for odor production is reduced.

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

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

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

158. Which of the following wastewater treatment terms may also be accomplished by composting, heat treatments, drying or the addition of lime or other alkaline materials?

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

Biological Criteria

159. A water body in its natural condition is free from _____, habitat loss, and other negative stressors.

- A. Allowable concentrations
- B. Harmful effects of pollution
- C. In a healthy aquatic community
- D. Acute (short term) and chronic (long term)
- E. Human health and aquatic life criteria
- F. None of the Above

160. Biological wastewater treatment goals are to remove the non-settling solids and the dissolved organic load from the effluents by using microbial populations.

- A. True
- B. False

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

- A. True
- B. False

162. The microorganisms used are responsible for the degradation of the term and the stabilization of organic wastes.

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

163. Some of the micro-organisms present in wastewater treatment systems use the _____ of the wastewater as an energy source to grow?

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

Genera

164. In a single aerobic system, members of the genera Pseudomonas, Nocardia, Flavobacterium, Achromobacter and Zooglea may be present, together with filamentous organisms.

- A. True
- B. False

165. In a well-functioning system, protozoas and rotifers are usually present and are useful in consuming dispersed _____ or non-settling particles.

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

166. The organic load present is incorporated in part as represented by which term by the microbial populations, and almost all the rest is liberated as gas.

- A. Biological denitrification
- B. Organic load
- C. Bacteria
- D. Biomass
- E. Aerobic and facultative micro-organisms
- F. None of the Above

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

- A. True
- B. False

168. The biological treatment processes used for wastewater treatment are broadly classified as aerobic in which aerobic and facultative micro-organisms predominate or anaerobic which use?

- A. Biological denitrification
- B. Organic load
- C. Anaerobic micro-organism
- D. Nitrogen and phosphorus
- E. Aerobic and facultative micro-organisms
- F. None of the Above

169. Which of the following terms means the micro-organisms that are attached to a surface over which they grow are called "attached growth processes"?

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

Aerobic Processes

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

- A. True
- B. False

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

- 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

172. Which of the following terms are usually designed from pilot plant and laboratory studies?

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

173. Which of the following terms is the amount of food provided to the bacteria in the aeration tank (the food-to-microorganism ratio, F/M)?

- 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

174. Swimming and _____ engulf bacteria or other prey.

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

175. Which of the following bugs or terms attach to the biomass and vortex suspended bacteria into their gullets, while crawlers break bacteria loose from the floc surface?

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

176. 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. Strict aerobes
- B. Swimming ciliates
- C. Bacteria
- D. Heterotrophic bacteria
- E. Many bacterial species
- F. None of the Above

177. The following changes in food, dissolved oxygen, temperature, pH, total dissolved solids, sludge age, presence of toxins, and other factors create a dynamic environment for the?

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

178. Food (organic loading) regulates?

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

Aerobic Bacteria

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

A. True B. False

180. Which of the following bugs or terms which occur are similar to those found in other treatment processes such as activated sludge?

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

181. Which of the following bugs or terms that degrade wastes grow as single bacteria dispersed in the wastewater?

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

182. Which of the following bugs or terms, grow in a large aggregate due to exocellular polymer production?

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

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

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

184. Which of the following bugs or terms occur in lagoons, usually at specific growth environments?

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

185. Which of the following bugs or terms have a wide range in environmental tolerance and can function effectively in BOD removal over a wide range in pH and temperature?

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

186. Anaerobic BOD removal generally proceeds well from pH 6.5 to 9.0 and at temperatures from 3-4°C to 60-70°C (Aerobic bacteria are replaced by Mesophilic bacteria at temperatures above 35°C).

A. True B. False

187. BOD removal increases rapidly below 3-4°C and ceases at 1-2°C.

A. True B. False

188. A very specialized group of bacteria occurs to some extent in lagoons (and other wastewater treatment systems) that can oxidize ammonia via nitrite to nitrate, termed?

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

Aerated Lagoons

189. The aerated lagoons are basins, normally excavated in earth and operated without Solids recycling into the system. This is the major difference with respect to activated sludge systems.

- A. True
- B. False

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

- A. True
- B. False

191. In the facultative lagoons, the power input is reduced causing accumulation of solids in the bottom which undergo _____, while the upper portions are maintained aerobic.

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

192. Lagoons are exposed to low temperatures which can cause _____ and eventually the formation of ice.

- A. Non-biodegradable fraction
- B. Substantial alkalinity
- C. Completely mixed lagoon
- D. Reduced biological activity
- E. Suspended solids in the effluent
- F. None of the Above

193. If excavated basins are used for settling, care should be taken to provide a residence time long enough for the?

- A. Facultative lagoon(s)
- B. Sludge
- C. Solids to settle
- D. Odors
- E. Complete nitrification
- F. None of the Above

194. Which of the following terms might develop in the upper layers contributing to an increased content of suspended solids in the effluent?

- A. Non-biodegradable fraction
- B. Substantial alkalinity
- C. Completely mixed lagoon
- D. Settled sludge, and algae
- E. Suspended solids in the effluent
- F. None of the Above

195. Which of the following terms can be minimized by using minimum depths of up to 2 m?

- A. Facultative lagoon(s)
- B. Sludge
- C. Aerated lagoon(s)
- D. Odors
- E. Complete nitrification
- F. None of the Above

196. According to the text, accumulated solids will, on the whole?
- A. Non-biodegradable fraction
 - B. Substantial alkalinity
 - C. Completely mixed lagoon
 - D. Decompose in the bottom
 - E. Suspended solids in the effluent
 - F. None of the Above

Nitrification

197. Nitrosomonas europaea, which oxidizes ammonia to nitrite, and Nitrobacter winogradskyi, which oxidizes nitrite to nitrate.
- A. True
 - B. False

198. Which of the following bugs require a neutral pH and substantial alkalinity?
- A. Nitrifying bacteria
 - B. Methane forming bacteria
 - C. Two bacteria
 - D. Aerobic bacteria
 - E. Anaerobic, heterotrophic bacteria
 - F. None of the Above

199. Nitrification ceases at pH values above pH 9 and declines markedly at pH values below 7.
- A. True
 - B. False

200. Nitrification, is a major pathway for nitrogen removal in lagoons.
- A. True
 - B. False

201. Nitrifying bacteria exists in low numbers in lagoons, they prefer attached growth systems and/or?
- A. Nitrifying bacteria
 - B. Methane forming bacteria
 - C. High MLSS sludge systems
 - D. Aerobic bacteria
 - E. Anaerobic, heterotrophic bacteria
 - F. None of the Above

Anaerobic Bacteria

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

Photosynthetic Organisms

203. Which of the following bugs or related terms included this diverse group of bacteria converts products from above under anaerobic conditions to simple alcohols and organic acids?
- A. BOD and sulfate
 - B. Methane fermentation
 - C. Methane bacteria
 - D. Organic overloading and anaerobic conditions
 - E. Acid-forming bacteria
 - F. None of the Above

204. Which of the following bugs or related terms these bacteria convert formic acid, methanol, methylamine, and acetic acid under anaerobic conditions to methane?
- A. Nitrifying bacteria
 - B. Methane forming bacteria
 - C. General anaerobic degraders
 - D. Aerobic bacteria
 - E. Anaerobic, heterotrophic bacteria
 - F. None of the Above

205. A problem exists at times where the acid formers overproduce organic acids, lowering the pH below where the methane bacteria can function (a pH < 6.5). This can stop methane formation and lead to a buildup of sludge in a lagoon with a low pH. In an anaerobic fermenter, this is called a "stuck digester".

- A. True B. False

206. Which of the following bugs or related terms are environmentally sensitive and have a narrow pH range of 6.5-7.5 and require temperatures > 14° C.

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

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

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

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

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

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

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

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

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

Treatment Lagoon

211. Which of the following related terms at a treatment lagoon is determined by the various chemical species of alkalinity that are present?

- A. Bicarbonate ion (HCO₃) D. pH
B. CO₂ E. Phosphorus
C. Carbonate ion (CO₂³⁻) F. None of the Above

212. High amounts of _____ yield a low lagoon pH, while high amounts of CO₂³⁻ yield a high lagoon pH.

- A. Alkalinity and pH D. Algal growth
B. CO₂ E. Phosphorus
C. BOD F. None of the Above

213. Bacterial growth on BOD releases CO₂ which subsequently dissolves in water to yield?.

- A. Bicarbonate ion (HCO₃)
- B. CO₂
- C. Carbonate ion (CO₂³)
- D. Carbonic acid (H₂CO₃)
- E. Phosphorus
- F. None of the Above

214. According to the text, algal growth in lagoons has the opposite effect on lagoon _____, raising the pH due to algal use for growth of inorganic carbon (CO₂ and HCO₃).

- A. Alkalinity and pH
- B. CO₂
- C. BOD
- D. pH
- E. Phosphorus
- F. None of the Above

215. Algal growth reduces the lagoon alkalinity which may cause the _____ to increase if the lagoon alkalinity (pH buffer capacity) is low.

- A. Bicarbonate ion (HCO₃)
- B. CO₂
- C. Carbonate ion (CO₂³)
- D. pH
- E. Phosphorus
- F. None of the Above

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

- A. Alkalinity and pH
- B. CO₂
- C. BOD
- D. All of the CO₂ and HCO₃
- E. Phosphorus
- F. None of the Above

217. pH caused by _____ can be beneficial.

- A. Bicarbonate ion (HCO₃)
- B. CO₂
- C. Carbonate ion (CO₂³)
- D. Algal growth
- E. Phosphorus
- F. None of the Above

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

- A. Alkalinity and pH
- B. CO₂
- C. BOD
- D. Algal growth
- E. Phosphorus
- F. None of the Above

Protozoans and Microinvertebrates

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

- A. True
- B. False

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

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

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

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

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

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

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

- A. True
- B. False

Activated Sludge Methods

Organic Load

224. The organic load (generally coming from primary treatment operations such as settling, screening or flotation) enters the reactor where the active microbial population is present. The reactor must be continuously aerated.

- A. True
- B. False

225. The mixture then passes to a settling tank where the cells are settled. The treated wastewater is disinfected while the secondary settling and is recycled in part to the aeration basin.

- A. True
- B. False

226. According to the text, as the cells are retained longer in the system, the flocculating characteristics of the cells improve since they start to produce extra cellular slime which favors?

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

Common Types

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

- A. True
- B. False

228. In the completely mixed process the inflow streams are usually introduced at several points to facilitate the homogeneity of the mixing; if the mixing is complete, the properties are constant throughout the reactor.

- A. True
- B. False

Paramecium sp.

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

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

230. Which of the following bugs is uniformly ciliated over the entire body surface with longer cilia tufts at the rear of the cell.

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

231. Paramecium may also be seen paired up with another _____ which makes a good diagnostic key.

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

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

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

Vorticella sp.

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

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

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

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

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

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

236. According to the text, Vorticella is a?

- A. Mixed liquor
- B. Bacteria
- C. Stalked ciliate
- D. Free-swimming and stalked ciliate(s)
- E. Contracting stalk
- F. None of the Above

Euglypha sp.

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

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

238. The shell of this bug is often transparent, allowing the hyaline (watery) body to be seen inside the shell.

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

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

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

240. Which of the following bugs is a shelled (testate) amoeba?

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

241. Which of the following bugs have a rigid covering which is either secreted or built from sand grains or other extraneous materials?

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

Euchlanis sp.

242. Which of the following bugs has a glassy shell secreted by its outer skin?

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

243. A characteristic of this creature is their mastax?

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

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

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

Filamentous Bacteria

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

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

246. According to the text, filamentous Bacteria function similar to _____ since they degrade BOD quite well.

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

247. According to the text, filaments are _____ that grow in long thread-like strands or colonies.

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

Site Specific Bacteria

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

- A. True B. False

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

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

Facultative Bacteria

250. Most of the bacteria absorbing the organic material in a wastewater treatment system are facultative in nature, meaning they are adaptable to survive and multiply in either anaerobic or aerobic conditions.

- A. True B. False

251. According to the text, usually, facultative bacteria will be _____ unless there is some type of mechanical or biochemical process used to add oxygen to the wastewater.

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

252. According to the text, when bacteria are in the process of being transferred from one environment to another, the metamorphosis from _____ (and vice versa) takes place within a couple of hours.

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

Anaerobic Bacteria

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

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

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

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

255. A typical use for these bugs would be in a septic tank.

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

256. Which of the following terms or bugs release hydrogen sulfide as well as methane gas, both of which can create hazardous conditions?

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

257. Which of the following terms begins in the collection lines of a sewer system, deadly hydrogen sulfide or explosive methane gas can accumulate and be life threatening?

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

Aerobic Bacteria

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

- A. True
- B. False

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

- A. True
- B. False

Protozoans and Metazoans

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

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

261. Which of the following terms or bugs are also indicators of biomass health and effluent quality?

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

262. Which of the following terms or bugs are very similar to protozoans except that they are usually multi-celled animals?

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

263. Which of the following terms or bugs are typically found only in a well-developed biomass?

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

264. Which of the following terms or bugs and the relative abundance of certain species can be a predictor of operational changes within a treatment plant?

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

Dispersed Growth

265. Dispersed growth is material suspended within the activated sludge process that has not been adsorbed into the floc particles. This material consists of very small quantities of colloidal (too small to settle out) bacteria as well as organic and inorganic particulate material.

A. True B. False

266. According to the text, while a small amount of _____ between the floc particles is normal, excessive amounts can be carried through a secondary clarifier.

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Dispersed growth
- E. Anaerobic sludge
- F. None of the Above

Activated Sludge Aerobic Flocs

267. Aerobic flocs in a healthy state are referred to as activated sludge. While aerobic floc has a metabolic rate approximately 10 times higher than anaerobic sludge, it can be increased even further by exposing the bacteria to an abundance of oxygen.

A. True B. False

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

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Dramatically reduced or totally eliminated
- F. None of the Above

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

269. Which of the following terms' content in clarified effluent, which may be due to too high or too low solids retention time and to growth of filamentous microorganisms?

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

270. Which of the following wastewater treatment related terms occurs when sludge that normally settles rises back to the surface after having settled?

- A. Denitrification process
- B. Organic material
- C. Bulking sludge
- D. Insufficient aeration in the reactor
- E. Rising sludge
- F. None of the Above

Filamentous Organisms

271. Which of the following wastewater treatment related terms reach too high a concentration, they can extend dramatically from the floc particles?

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

272. Which of the following wastewater treatment related terms, because of the increased surface area and without a corresponding increase in mass, this will not settle well?

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

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

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

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

- A. True
- B. False

275. Filamentous organisms serve to strengthen the?

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

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

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

Filamentous Bacteria Identification

277. Filamentous Identification should be used as a tool to monitor the health of the biomass when a floating scum mat is suspected.

- A. True
- B. False

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

- A. True
- B. False

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

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

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

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

Nocardia amarae

281. *Nocardia amarae*, a common cause of Gram-positive, chemoautotrophic, filamentous in waste treatment plants, is a slow growing, usually gram-positive, chemoautotrophic, filamentous, strict aerobe that produces the biosurfactant trehalose.

- A. True
- B. False

282. Colonies can be _____, so color alone is not a key to identifying this species.

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

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

- A. True
- B. False

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

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

Nostocoida limicola

285. *Nostocoida limicola* is yet another common cause of disruptive foaming in waste treatment plants, motile in its Hormogonia and sometimes Trichome phases. This oxygenic phototrophic species often forms multicellular rigid filaments, forming non-symbiotic relationships with other species.

- A. True
- B. False

Thiothrix

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

- A. True
- B. False

287. *Thiothrix* are considered _____, using several small organic carbons and reduced inorganic sulfur sources for growth and energy.

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

Microthrix parvicella

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

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

Sphaeroliticus natans

289. *Sphaeroliticus natans* is another filamentous species, and yet it is reputed to increase settleability by branching between flocs, increasing surface area.

- A. True
- B. False

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

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

Filamentous Bacteria

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

A. True B. False

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

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

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

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

Other Wastewater Treatment Components

Biochemical Oxygen Demand

294. Biochemical Oxygen Demand (BOD or BOD₅) is an indirect measure of Biodegradable organic compounds in water, and is determined by measuring the dissolved oxygen decrease in a controlled water sample over a five-day period.

A. True B. False

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

A. True B. False

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

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

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

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

Organic Carbon

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

A. True B. False

299. Dead tissue containing carbon is decomposed as _____ by bacteria and other microbes.

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

Total Organic Carbon

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

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

Nutrient Constituents in Wastewater and Measurement Methods

Nitrogen

301. The major contributors of nitrogen to wastewater are _____ such as food preparation, showering, and waste excretion.

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

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

- A. True
- B. False

303. Which of the following terms in domestic wastewater typically ranges from 20 to 70 mg/L for low to high strength wastewater?

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

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

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

The TKN method has three major steps:

305. Digestion to convert organic nitrogen to?

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

306. Conversion of _____ into condensed ammonia gas through addition of a strong base and boiling.

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

307. Measuring the concentration includes ammonia, with _____ being subtracted from the TKN to determine organic nitrogen.

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

308. Nitrogen components in wastewater are typically reported on an “_____” basis?

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

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

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

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

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

311. Which of the following terms may be released in secondary treatment by microorganisms either through metabolism or upon death and lysis?

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

312. Which of the following terms happens by microorganisms releases some organic nitrogen as dissolved, biodegradable compounds?

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

313. Other forms of _____ may be more persistent in wastewater treatment processes.

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

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

- A. True
- B. False

Phosphorus

315. Which of the following terms in domestic wastewater typically ranges between 4 and 8 mg/L but can be higher depending on sources?
- A. Phosphorus as phosphate
 - B. Phosphorus
 - C. Orthophosphate
 - D. Pyrophosphate and trimetaphosphate
 - E. Total phosphorus (TP)
 - F. None of the Above

Advanced Treatment Section Types of Processes

316. Which of the following terms operate without heating and therefore use less energy than conventional thermal separation processes such as distillation, sublimation or crystallization?

- A. Brackish groundwater
- B. Macromolecule(s)
- C. RO membrane(s)
- D. Conventional thermal separation process(es)
- E. Membrane separation processes
- F. None of the Above

317. Which of the following terms uses membrane technology and is widely used in the food technology, biotechnology and pharmaceutical industries?

- A. The recovery of organic vapor(s)
- B. Fractional distillation
- C. Cold separation
- D. A selective barrier
- E. Thermal separation method(s)
- F. None of the Above

318. According to the text, it is impossible to separate the constituents of azeotropic liquids or solutes which form isomorphous crystals by distillation or recrystallization but such separations can be achieved using _____.

- A. Brackish groundwater
- B. Macromolecule(s)
- C. Membrane technology
- D. Conventional thermal separation process(es)
- E. RO membrane(s)
- F. None of the Above

319. Applications include the production of drinking water by _____ (worldwide approximately 7 million cubic meters annually), filtrations in the food industry, the recovery of organic vapors such as petro-chemical vapor recovery and the electrolysis for chlorine production.

- A. The recovery of organic vapor(s)
- B. Fractional distillation
- C. Reverse osmosis
- D. A selective barrier
- E. Thermal separation method(s)
- F. None of the Above

320. Wastewater treatment membrane technology is becoming increasingly important. With the help of _____ it is possible to remove particles, colloids and macromolecules, so that waste-water can be disinfected in this way.

- A. Ultra/microfiltration
- B. Macromolecule(s)
- C. Solute(s)
- D. Conventional thermal separation process(es)
- E. RO membrane(s)
- F. None of the Above

321. Many azeotropic mixtures of pairs of compounds are known, and many azeotropes of three or more compounds are also known, it is not possible to separate the components by _____.

- A. The recovery of organic vapor(s)
- B. Fractional distillation
- C. Large molecules, or ions
- D. A selective barrier
- E. Thermal separation method(s)
- F. None of the Above

Membrane Filtration Processes

322. Which of the following terms enables some water systems having contaminated water sources to meet new, more stringent regulations?
- A. Membrane technology
 - B. Macromolecule(s)
 - C. Solute(s)
 - D. Conventional thermal separation process(es)
 - E. RO membrane(s)
 - F. None of the Above

Description of Membrane Filtration Processes

323. Which of the following terms water is forced through a porous membrane under pressure, while suspended solid, large molecules, or ions are held back or rejected?
- A. The recovery of organic vapor(s)
 - B. Fractional distillation
 - C. Membrane processes
 - D. A selective barrier
 - E. Thermal separation method(s)
 - F. None of the Above

Microfiltration

324. The current primary use of MF is by industries to remove very fine particles from process water, the process has also been used as a pretreatment for?
- A. Reverse osmosis or RO
 - B. Potable water treatment
 - C. Other membrane processes
 - D. Direct filtration process
 - E. Microfiltration or MF
 - F. None of the Above

325. RO membranes are susceptible to clogging or filter binding unless the _____ being processed is already quite clean.
- A. Process liquid
 - B. Chloride and sodium
 - C. Total dissolved solids (TDS)
 - D. Material
 - E. Water
 - F. None of the Above

326. Which of the following terms has been proposed as a filtering method for particles resulting from the direct filtration process?
- A. Reverse osmosis or RO
 - B. Potable water treatment
 - C. Colloids and substances
 - D. Direct filtration process
 - E. Microfiltration or MF
 - F. None of the Above

327. The use of filter aids to improve filtering efficiency, especially for small particles that could contain _____ are recommended.
- A. Process liquid
 - B. Chloride and sodium
 - C. Total dissolved solids (TDS)
 - D. Material
 - E. Bacterial and protozoan life
 - F. None of the Above

Ultrafiltration

328. The smaller pore size is designed to remove colloids and substances that have larger molecules, which are called?
- A. Reverse osmosis or RO
 - B. Potable water treatment
 - C. High-molecular-weight materials
 - D. Direct filtration process
 - E. Microfiltration or MF
 - F. None of the Above

329. UF membranes can be designed to pass material that weigh less than or?
- A. Process liquid
 - B. Chloride and sodium
 - C. Total dissolved solids (TDS)
 - D. Material
 - E. Equal to a certain molecular weight
 - F. None of the Above

330. UF does not generally work well for removal of _____, it can be used effectively for removal of most organic chemicals.

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Salt or dissolved solids
- F. None of the Above

Nanofiltration

331. Nanofiltration (NF) process has been used primarily for water softening and reduction of?

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Bacterial and protozoan life
- F. None of the Above

332. NF capability will undoubtedly increase the use of _____ for potable water treatment.

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. NF
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

Reverse Osmosis

333. RO membranes have very low MWC pore size that can reject ions at very high rates, including?

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Bacterial and protozoan life
- F. None of the Above

334. RO also works most organic chemicals, and radionuclides and microorganisms. Industrial water uses such as semiconductor manufacturing is also an important?

- A. RO process
- B. Potable water treatment
- C. Colloids and substances
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

Microfiltration Specific Process

335. Microfiltration is a type of physical filtration process where a contaminated fluid is passed through a special pore-sized membrane to separate microorganisms and suspended particles from?

- A. Process liquid
- B. Chloride and sodium
- C. Total dissolved solids (TDS)
- D. Material
- E. Bacterial and protozoan life
- F. None of the Above

336. Which of the following terms works with such as ultrafiltration and reverse osmosis to provide a product stream which is free of undesired contaminants?

- A. Various other separation processes
- B. MF membranes
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. None of the Above

337. Microfiltration usually serves as a pre-treatment for other separation processes such as?

- A. Cross flow filtration
- B. Filtration process(es)
- C. Performance of microfiltration
- D. Ultrafiltration
- E. Microfiltration process
- F. None of the Above

Common Applications

Water Treatment Process

338. Which of the following terms presents a physical means of separation (a barrier) as opposed to a chemical alternative?

- A. Fouling
- B. MF membranes
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. None of the Above

339. Which of the following terms are used in secondary wastewater effluents to remove turbidity but also to provide treatment for disinfection?

- A. Cross flow filtration
- B. Filtration process(es)
- C. Performance of microfiltration
- D. MF membranes
- E. Microfiltration process
- F. None of the Above

Driving Force, Retentate Stream and Permeate Streams

340. Which of the following terms can be distinguished by three major characteristics; Driving force, retentate stream and permeate streams?

- A. Membrane filtration processes
- B. MF membranes
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. None of the Above

341. Which of the following terms is pressure driven with suspended particles and water as retentate and dissolved solutes plus water as permeate?

- A. Cross flow filtration
- B. Filtration process(es)
- C. Performance of microfiltration
- D. Species such as phosphorus and arsenic
- E. Microfiltration process
- F. None of the Above

342. Which of the following terms accelerates the separation process by increasing the flow rate (flux) of the liquid stream but does not affect the chemical composition of the species in the retentate and product streams?

- A. Fouling
- B. The use of hydraulic pressure
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. None of the Above

Fouling

343. A major characteristic that limits the performance of microfiltration or any membrane technology is a process known as?

- A. Cross flow filtration
- B. Filtration process(es)
- C. Performance of microfiltration
- D. Fouling
- E. Microfiltration process
- F. None of the Above

344. Which of the following terms describes the deposition and accumulation of feed components such as suspended particles, impermeable dissolved solutes or even permeable solutes, on the membrane surface and or within the pores of the membrane?

- A. Fouling
- B. MF membranes
- C. Ultrafiltration and reverse osmosis
- D. Batch or semi-continuous filtration
- E. Retentate and product streams
- F. None of the Above

345. Fouling of the membrane during the filtration processes decreases the flux and thus overall efficiency of the operation. This is indicated when the pressure drop increases to a certain point. It occurs even when operating parameters are constant (pressure, flow rate, temperature and concentration)

A. True B. False

Nanofiltration (NF) Section

346. Nanofiltration is a relatively recent membrane filtration process used most often with low total dissolved solids water with the purpose of softening (polyvalent cation removal) and removal of _____ such as natural organic matter and synthetic organic matter.

A. Process liquid D. Disinfection by-product precursors
B. Chloride and sodium E. Partial (monovalent ion) demineralization
C. Material F. None of the Above

347. Nanofiltration is also becoming more widely used in food processing applications and for _____ and partial (monovalent ion) demineralization.

A. Process liquid D. Natural organic matter and synthetic organic matter
B. Chloride and sodium E. Simultaneous concentration
C. Material F. None of the Above

348. Which of the following terms is a membrane filtration-based method that uses nanometer sized cylindrical through-pores that pass through the membrane at 90°?

A. Reverse osmosis or RO D. Direct filtration process
B. Potable water treatment E. Microfiltration or MF
C. Nanofiltration F. None of the Above

349. Nanofiltration membranes have pore sizes from 1-10 nanometers, smaller than that used in microfiltration and?

A. Reverse osmosis or RO D. Direct filtration process
B. Potable water treatment E. Microfiltration or MF
C. Ultrafiltration F. None of the Above

350. Which of the following terms are controlled by pH, temperature and time during development with pore densities ranging from 1 to 106 pores per cm²?

A. Gentle molecular separation D. Pore dimensions
B. Method of softening water E. Tracking
C. Solvent-stable membrane(s) F. None of the Above

351. Membranes made from polyethylene terephthalate are referred to as _____, named after the way the pores on the membranes are made.

A. Track-etch" membrane(s) D. Organic solvent nanofiltration technology
B. Membrane(s) E. Nanofiltration
C. Nanofilter(s) F. None of the Above

352. "Tracking" results in making tracks that are chemically developed into the membrane, or _____ into the membrane, which are the pores.

A. Gentle molecular separation D. "Etched"
B. Method of softening water E. Tracking
C. Solvent-stable membrane(s) F. None of the Above

353. According to the text, membranes created from metal such as _____, are made by electrochemically growing a thin layer of aluminum oxide from aluminum metal in an acidic medium.

- A. Track-etch" membrane(s)
- B. Membrane(s)
- C. Nanofilter(s)
- D. Organic solvent nanofiltration technology
- E. Alumina membranes
- F. None of the Above

Range of Applications

354. The original uses for nanofiltration were water treatment and?

- A. Gentle molecular separation
- B. Method of softening water
- C. Solvent-stable membrane(s)
- D. Water softening
- E. Tracking
- F. None of the Above

355. Which of the following terms can "soften" water by retaining scale-forming, hydrated divalent ions (e.g. Ca^{2+} , Mg^{2+}) while passing smaller hydrated monovalent ions?

- A. Track-etch" membrane(s)
- B. Membrane(s)
- C. Nanofilter(s)
- D. Organic solvent nanofiltration technology
- E. Nanofiltration
- F. None of the Above

356. Which of the following terms has allowed the application for nanofiltration membranes to extend into new areas such as pharmaceuticals, fine chemicals, and flavor and fragrance industries?

- A. Gentle molecular separation
- B. Method of softening water
- C. Solvent-stable membrane(s)
- D. Water softening
- E. Tracking
- F. None of the Above

357. Organic solvent nanofiltration technology and _____ used has extended possibilities for applications in a variety of organic solvents ranging from non-polar through polar to polar aprotic.

- A. Track-etch" membrane(s)
- B. Membrane(s)
- C. Nanofilter(s)
- D. Commercialization of membranes
- E. Nanofiltration
- F. None of the Above

Advantages and Disadvantages

358. One of the main advantages of nanofiltration as a method of softening water is that during the process of retaining calcium and magnesium ions while passing smaller hydrated monovalent ions, filtration is performed without adding extra sodium ions, as used in ion exchangers.

- A. True
- B. False

359. Which of the following terms do not operate at room temperature (e.g. distillation), which greatly increases the cost of the process when continuous heating or cooling is applied?

- A. Track-etch" membrane(s)
- B. Membrane(s)
- C. Nanofilter(s)
- D. Organic solvent nanofiltration technology
- E. Many separation processes
- F. None of the Above

360. Which of the following terms is linked with nanofiltration that is often not included with other forms of separation processes (centrifugation)?

- A. Gentle molecular separation
- B. Method of softening water
- C. Solvent-stable membrane(s)
- D. Water softening
- E. Tracking
- F. None of the Above

361. Which of the following terms has a very favorable benefit of being able to process large volumes and continuously produce streams?

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

362. Anything smaller, reverse osmosis is used and anything larger is used for?

- A. Ultrafiltration
- B. Potable water treatment
- C. NF
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

363. Which of the following terms can also be used in cases where nanofiltration can be used, due to it being more conventional?

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. NF
- D. Ultrafiltration
- E. Microfiltration or MF
- F. None of the Above

364. Which of the following terms membranes are an expensive part of the process. Repairs and replacement of membranes is dependent on total dissolved solids, flow rate and components of the feed?

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

365. Which of the following terms being used across various industries, only an estimation of replacement frequency can be used?

- A. Reverse osmosis or RO
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

Reverse Osmosis Process Section

366. Osmosis is a natural phenomenon in which a liquid - water in this case - passes through a semi-permeable membrane from a relatively dilute solution toward a more concentrated solution. This flow produces a measurable pressure, called osmotic pressure.

- A. True
- B. False

367. Which of the following terms produces high quality water at low cost compared to other purifications processes?

- A. Pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. RO
- E. Waste (concentrate)
- F. None of the Above

368. Which of the following is determined by the total dissolved solids content of the saline solution, or contaminated solution on one side of the membrane?

- A. This pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. Virtually 100% of colloidal and suspended matter
- E. Waste (concentrate)
- F. None of the Above

369. The higher the content of dissolved solids, the higher the?

- A. Pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. Virtually 100% of colloidal and suspended matter
- E. Waste (concentrate)
- F. None of the Above

370. Which of the following result in higher osmotic pressures?

- A. Pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. Colloidal and suspended matter
- E. Waste (concentrate)
- F. None of the Above

371. According to the text, common tap water as found in most areas may have an osmotic pressure of about 10 PSI (Pounds per Square Inch), or about?

- A. 36,000 PPM
- B. A pressure of 10 PSI
- C. Osmotic pressure(s)
- D. 1.68 Bar
- E. 376 PSI
- F. None of the Above

372. According to the text, Seawater at _____ typically has an osmotic pressure of about 376 PSI (26.75 Bar).

- A. 36,000 PPM
- B. A pressure of 10 PSI
- C. Osmotic pressure(s)
- D. 1.68 Bar
- E. 56 PSI
- F. None of the Above

373. To reach the point at which osmosis stops for tap water, a pressure of 10 PSI would have to be applied to the saline solution, and to stop osmosis in seawater, a pressure of _____ would have to be applied to the seawater side of the membrane.

- A. 36,000 PPM
- B. A pressure of 10 PSI
- C. Osmotic pressure(s)
- D. 1.68 Bar
- E. 376 PSI
- F. None of the Above

Brine Channel

374. Concentrated raw water is called the reject stream or concentrate stream, it may also be called brine if it is coming from a?

- A. Each sheet of membrane material
- B. Microporous support layer
- C. Salt water source
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

375. Which of the following terms when sufficient flows are maintained, serves to carry away the impurities removed by the membrane, thus keeping the membrane surface clean and functional?

- A. Pressure differential
- B. Osmotic pressure
- C. Higher molecular weights
- D. The concentrate
- E. Waste (concentrate)
- F. None of the Above

376. The membrane material itself is a special thin film composite (TFC) polyamide material, cast in a microscopically thin layer on another, thicker cast layer of Polysulfone called?

- A. Membrane material
- B. Microporous support layer
- C. Brine material
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

377. Each sheet of membrane material is inspected at special light tables to ensure the quality of the membrane coating, before being assembled into the?

- A. Spiral wound element design
- B. Microporous support layer
- C. Brine channel
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

378. To achieve Reverse Osmosis, the _____ pressure is generally doubled.

- A. Each sheet of membrane material
- B. Osmotic
- C. Brine channel
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

379. The inverse occurs with lower temperatures, in that salt passage decreases (reducing the _____ in the permeate or product water), while operating pressures increase. Or, if operating pressures do not increase, then the amount of permeate or product water is reduced.

- A. TDS
- B. Raw water
- C. Seawater and brackish water
- D. Salt
- E. Concentrate
- F. None of the Above

380. The rejection rate is the percentage of _____ rejected, or prevented from passing through the membrane.

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Dissolved solids
- E. Concentrate
- F. None of the Above

381. A membrane with a rejection rate of 99% (usually based on Na (Sodium)) will allow only 1% of the concentration of _____ to pass through into the permeate.

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Dissolved solids
- E. Concentrate
- F. None of the Above

382. As the raw water is processed, the concentrations of _____ increase as it passes along the membrane's length and usually multiple membranes are employed, with each membrane in series seeing progressively higher dissolved solids levels.

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. TDS
- E. Concentrate
- F. None of the Above

383. Typically, starting with seawater of 36,000 PPM, standard rejection membranes produce?

- A. Each sheet of membrane material
- B. Permeate below 500 PPM
- C. Brine
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

384. Optimum flows and pressures, optimum recovery rates (the _____ from a given stream of raw water), prefiltration and other pretreatment considerations, and so forth.

- A. Percentage of permeate
- B. Microporous support layer
- C. Brine channel
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

385. Well-designed systems employ multiple stages of prefiltration, tailored to the application, including _____ and one or more stages of cartridge filtration.

- A. Each sheet of membrane material
- B. Microporous support layer
- C. Multi-media filtration
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

386. Which of the following terms has proved to be the most reliable and cost effective method of desalinating water, and hence its use has become more and more widespread?

- A. Reverse Osmosis
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

387. Which of the following terms is usually some 70% less than for comparable evaporation technologies?

- A. Reverse Osmosis
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Energy consumption
- F. None of the Above

388. Which of the following terms have been improved as well, reducing maintenance and down time?

- A. Each sheet of membrane material
- B. Microporous support layer
- C. Brine channel
- D. Amount of permeate or product water
- E. Component parts
- F. None of the Above

389. Which of the following terms delivers product water or permeate having essentially the same temperature as the raw water source?

- A. Reverse Osmosis
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

390. R/O Systems can be designed to deliver virtually any?

- A. Each sheet of membrane material
- B. Microporous support layer
- C. Required product water quality
- D. Amount of permeate or product water
- E. Concentrations of TDS
- F. None of the Above

391. Reverse osmosis, also known as?

- A. Hyperfiltration
- B. Potable water treatment
- C. Nanofiltration
- D. Direct filtration process
- E. Microfiltration or MF
- F. None of the Above

392. Reverse osmosis is used to purify water and remove salts and other impurities in order to improve the color, taste, or properties of the?

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Fluid
- E. Concentrate
- F. None of the Above

393. RO can be used to purify fluids such as ethanol and glycol, which will pass through the reverse osmosis membrane, while rejecting?

- A. Percentage of permeate
- B. Raw water
- C. Ions and contaminants
- D. Salt
- E. Concentrate
- F. None of the Above

394. RO is used to produce _____ that are currently in place.

- A. Permeate
- B. Raw water
- C. Water
- D. Water that meets the most demanding specifications
- E. Concentrate
- F. None of the Above

395. Reverse osmosis technology uses a process known as _____ to allow the membrane to continually clean itself.

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Cross-flow
- E. Concentrate
- F. None of the Above

396. Which of the following terms passes through the membrane the rest continues downstream, sweeping the rejected species away from the membrane?

- A. Some of the fluid
- B. The higher the pressure
- C. A driving force
- D. Purify fluid(s)
- E. Cross-flow
- F. None of the Above

397. According to the text, the process of reverse osmosis _____ through the membrane, and the most common force is pressure from a pump.

- A. Percentage of permeate
- B. Raw water
- C. A driving force to push the fluid
- D. Salt
- E. Concentrate
- F. None of the Above

398. Which of the following terms of the fluid being rejected increases, the driving force required to continue concentrating the fluid increases?

- A. The concentration
- B. The higher the pressure
- C. A driving force
- D. Purify fluid(s)
- E. Cross-flow
- F. None of the Above

399. RO is capable of rejecting bacteria, salts, _____, proteins, particles, dyes, and other constituents that have a molecular weight of greater than 150-250 daltons.

- A. Percentage of permeate
- B. Raw water
- C. Seawater and brackish water
- D. Sugars
- E. Concentrate
- F. None of the Above

400. The separation of ions with reverse osmosis is aided by?

- A. Charged Particles
- B. The higher the pressure
- C. A driving force
- D. Filter aids
- E. Cross-flow
- F. None of the Above