

Registration Form

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**48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

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

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

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

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# OSSF Answer Key

Name \_\_\_\_\_ Phone \_\_\_\_\_

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***Please circle, underline, bold or X only one correct answer***

Please Circle, Bold, Underline or X, one answer per question. A **felt tipped pen** works best.

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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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## OSSF CEU Training Assignment

You will have 90 days from the start of this assignment to finish it. Only one answer per question. Please utilize the Answer Key. Please fax or e-mail your completed answer key and registration form to TLC.

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

### ONSITE SEWAGE FACILITIES (OSSF) ONSITE SYSTEMS SECTION

1. Onsite sewage treatment systems provide septic system owners with \_\_\_\_\_ to keep their septic systems functioning properly.
- A. The tank effluent                      C. Primary and secondary treatment  
B. Best management practices      D. None of the above

#### **Onsite Sewage Facilities (OSSF)**

2. Onsite/decentralized wastewater treatment systems, normally called septic system(s), treat sewage from homes and businesses that are not connected to a \_\_\_\_\_.
- A. Decentralized sewer system(s)      C. Centralized wastewater treatment plant  
B. Municipal wastewater treatment      D. None of the above
3. Which of the following include individual onsite septic systems, cluster systems, and alternative wastewater treatment technologies like constructed wetlands, recirculating sand filters, mound systems, and ozone disinfection systems?
- A. Decentralized treatment systems      C. Centralized wastewater treatment plant  
B. Municipal wastewater treatment      D. None of the above
4. A septic tank and drainfield combination is the oldest and most common type of OSSF, although newer aerobic and biofilter units exist which represent scaled down versions of \_\_\_\_\_.
- A. Groundwater system(s)                      C. Collection system  
B. Municipal sewage treatments              D. None of the above
5. OSSFs account for about \_\_\_\_\_% of all domestic wastewater treatment in the United States.
- A. 25                                      C. 50  
B. 15                                      D. None of the above

**(s) means the answer may be plural or singular in nature.**

### Types of Sewer Systems

6. Centralized sewer systems are usually broken out into three different categories: sanitary sewers, storm sewers, and \_\_\_\_\_.
- A. Septic system(s)                      C. Onsite wastewater management program(s)  
B. Combined sewers                      D. None of the above
7. Which of the following are designed to get rainwater off the streets during rain events?
- A. Septic system(s)                      C. Storm sewers  
B. Combined sewers                      D. None of the above
8. Most \_\_\_\_\_ do not connect with a treatment plant, but instead drain directly into nearby rivers, lakes, or oceans.
- A. Septic system(s)                      C. Storm sewers  
B. Combined sewers                      D. None of the above

### Key Terms

9. Which of following the means a sewage treatment plant that incorporates a means of introducing air and oxygen into the sewage to provide aerobic biochemical stabilization during a detention period?
- A. Alternative System                      C. Aerobic Sewage Treatment Facility  
B. Aerobic System                      D. None of the above
10. Which of following the means an alternative system that incorporates a septic tank or other treatment facility, an aerobic sewage treatment facility, and an absorption facility to provide treatment before dispersal?
- A. Alternative System                      C. Aerobic Sewage Treatment Facility  
B. Aerobic System                      D. None of the above
11. Which of following the means any onsite wastewater treatment system DEQ or the Commission approves for use in lieu of the standard subsurface system?
- A. Alternative System                      C. Aerobic Sewage Treatment Facility  
B. Aerobic System                      D. None of the above
12. Which of following the means may include anaerobic processes as part of the treatment system?
- A. Alternative System                      C. Aerobic Sewage Treatment Facility  
B. Aerobic System                      D. None of the above

### Onsite Treatment Processes Options

13. The high cost of \_\_\_\_\_ and the advances made in individual and cluster (decentralized) system technologies have expanded the array of available treatment options and supported development of a more tailored approach to wastewater management services.
- A. Sewage                                      C. Centralized wastewater treatment plants  
B. Collection system                      D. None of the above
14. Options now exist that span the full spectrum of treatment facilities, from large centralized plants, to \_\_\_\_\_, to individual treatment systems providing conventional or enhanced service.
- A. Large and small soil-discharging clustered facilities                      C. Collection system  
B. Centralized wastewater treatment plants                      D. None of the above

**Basic Onsite Treatment Processes**

15. Which of the following are designed to accomplish the same thing—the treatment of wastewater—but how this is accomplished is based on the type of treatment technology used?
- A. Individual and clustered wastewater systems
  - B. Centralized wastewater system(s)
  - C. Collection system(s)
  - D. None of the above

**Primary Treatment**

16. Physical treatment processes involving capture of solids and fats/oils/grease in an enclosed vessel, typically by settling and flotation, such as provided in a septic tank or grease interceptor tank. This process also includes trapping of solids via \_\_\_\_\_ or screens prior to discharge of the tank effluent.
- A. Conventional system(s)
  - B. The tank effluent
  - C. Septic tank effluent filters
  - D. None of the above

**Secondary Treatment**

17. Which of the following designed to remove organic matter, mostly through digestion and decomposition, often aided by introduction of or exposure to atmospheric oxygen?
- A. Wastewater
  - B. Onsite sewage treatment
  - C. Biological and chemical processes
  - D. None of the above

**Key Septic Terms**

Identify the missing term.

18. Means the distribution of effluent to a set of absorption trenches in which each trench receives effluent in equivalent or proportional volumes.
- A. Equal Distribution
  - B. Holding Tank System
  - C. Intermittent Sand Filter
  - D. None of the above
19. Means a structure used for disposal of human waste without the aid of water. It consists of a shelter built above a pit or vault in the ground into which human waste falls.
- A. Septic tank
  - B. Cesspool
  - C. Privy
  - D. None of the above
20. Means a lined pit that receives raw sewage, allows separation of solids and liquids, retains the solids, and allows liquids to seep into the surrounding soil through perforations in the lining.
- A. Black Waste
  - B. Cesspool
  - C. Swamp
  - D. None of the above
21. Means the sidewall area within an absorption trench or a seepage trench from the bottom of the trench to a level 2 inches above the distribution pipes, the sidewall area of any cesspool, seepage pit, unsealed earth pit privy, graywater waste absorption sump seepage chamber, or trench with drain media substitute, or the bottom area of a pressurized soil absorption facility installed in soil.
- A. Alternative System
  - B. Cesspool
  - C. Effective Seepage Area
  - D. None of the above
22. Means a conventional sand filter.
- A. Fast sand filter
  - B. Slow sand filter
  - C. Intermittent Sand Filter
  - D. None of the above

23. Means an alternative system consisting of the combination of a holding tank, service riser, and level indicator (alarm), designed to receive and store sewage for intermittent removal for treatment at another location.

- A. Septic tank
- B. Holding Tank System
- C. Intermittent septic tank
- D. None of the above

**Septic System Basics Described**

24. Most tanks are split into two compartments and have pipe baffles and an outlet filter to ensure the \_\_\_\_\_ stay in the tank.

- A. Solids
- B. Liquids
- C. Biologic process
- D. None of the above

25. The \_\_\_\_\_ process begins in the tank where the effluent separates into layers and begins the process of decomposition.

- A. Physical
- B. Natural
- C. Biologic
- D. None of the above

26. Bacteria, which are naturally present in all septic systems, begin to digest the solids that have settled to the bottom of the tank, transforming a large percentage of these solids into liquids and \_\_\_\_\_.

- A. Solids
- B. Liquids
- C. Gases
- D. None of the above

27. When \_\_\_\_\_ within the tank rise to the level of the outflow pipe, they enter the next part of the treatment system (pre-treatment device, distribution box, pump chamber, etc., depending on the type of system).

- A. Solids
- B. Liquids
- C. Gases
- D. None of the above

**Types of Systems – General**

28. Standard gravity systems require \_\_\_\_\_ feet of "good" soil under the trenches while pressure distribution systems only require \_\_\_\_\_ feet.

- A. 3 & 3
- B. 2 & 3
- C. 3 & 2
- D. None of the above

29. Advanced Treatment systems are more complicated and treat the wastewater to a fairly high level before allowing it to reach the soil. Because of this treatment, they can be used where there is only \_\_\_\_\_ foot of "good" dirt beneath the trench bottom.

- A. 1
- B. 2
- C. 3
- D. None of the above

**Conventional Septic Systems Typically have three Main Components.**

30. Which of the following separates the solids from the liquids, and serves a storage area for the solids to decompose and if properly maintained will decompose the solids faster than they build up?

- A. A gravity system
- B. A septic tank
- C. A pressure distribution system
- D. None of the above

31. Which of the following allows the separated water to drain out of the system and to absorb into the leach field?

- A. A gravity system
- B. A drain field
- C. A pressure distribution system
- D. None of the above

**Pressure Distribution**

32. Pressure distribution systems are usually required when there is less than optimal soil depth available for complete treatment of the effluent by \_\_\_\_\_.

- A. A gravity system
- B. Septic system design
- C. A pressure distribution system
- D. None of the above

33. A minimum of \_\_\_\_\_ feet of properly drained soil is required under the trenches.

- A. Three
- B. Two
- C. Five
- D. None of the above

34. Which of the following are normally the same as a standard gravity system, but the method by which the effluent is distributed to the soil is different?

- A. A gravity system
- B. The tank and drainfield size
- C. A pressure distribution system
- D. None of the above

35. A pump is used to pressurize the effluent into a small underground pvc pipe which transports it to the \_\_\_\_\_.

- A. A gravity system
- B. Septic system design
- C. Drainfield
- D. None of the above

**Basic Onsite Wastewater Treatment Systems and Components**

36. Building sewers and other sewer lines: watertight pipes, which deliver waste by \_\_\_\_\_ from a building to the onsite system or carry effluent by gravity from sewage tanks to other system components.

- A. Gravity
- B. Pressure manifolds
- C. Lateral trenches
- D. None of the above

**Septic Tanks**

37. The septic tank's function is to separate solids from liquid, digest organic matter, store liquids through a period of detention and allow the \_\_\_\_\_ to discharge to other components of an onsite system.

- A. Biological processes
- B. Clarified liquids
- C. Organic matter
- D. None of the above

38. Which of the following are stored and periodically need to be pumped out and hauled to a point for further treatment?

- A. Gases
- B. Liquids
- C. Solids
- D. None of the above

**Septic/Sewage Tank Removal**

39. \_\_\_\_\_ need to be correctly abandoned to prevent them from becoming a safety hazard.

- A. Unused sewage tanks
- B. Pressure manifolds
- C. Lateral trenches
- D. None of the above

**Septic Treatment**

40. A septic tank removes many of the settleable solids, oils, greases, and floating debris in the raw wastewater, achieving \_\_\_\_\_ percent removal.

- A. 50 to 80
- B. 60 to 80
- C. 60 to 90
- D. None of the above

41. Which of the following removed are stored in sludge and scum layers, where they undergo liquefaction?

- A. Gases
- B. Liquids
- C. Solids
- D. None of the above

42. During liquefaction, the first step in the digestion process, acid forming bacteria partially digest the solids by hydrolyzing the proteins and converting them to \_\_\_\_\_, most of which are dissolved in the water phase.

- A. Organic suspended solid(s)
- B. Volatile fatty acid(s)
- C. BOD
- D. None of the above

43. The volatile fatty acids still exert much of the biochemical oxygen demand that was originally in the organic suspended solids. Because these acids are in the dissolved form, they are able to pass from the tank in the effluent stream, reducing the \_\_\_\_\_ removal efficiency of septic tanks compared to primary sedimentation.

- A. Organic suspended solid(s)
- B. Volatile fatty acid(s)
- C. BOD
- D. None of the above

44. Complete digestion, in which the volatile fatty acids are converted to methane, could reduce the amount of \_\_\_\_\_ released by the tank, but it usually does not occur to a significant extent because wastewater temperatures in septic tanks are typically well below the optimum temperature for methane producing bacteria.

- A. Organic suspended solid(s)
- B. Volatile fatty acid(s)
- C. BOD
- D. None of the above

45. Gases that form from the microbial action in the tank rise in the wastewater column. The rising gas bubbles disturb the \_\_\_\_\_, which can reduce the settling efficiency of the tank.

- A. Organic suspended solid(s)
- B. Volatile fatty acid(s)
- C. Quiescent wastewater column
- D. None of the above

46. Gases dislodge \_\_\_\_\_ in the sludge blanket so they can escape in the water column.

- A. Organic suspended solid(s)
- B. Colloidal particles
- C. BOD
- D. None of the above

47. At the same time, however, they can carry active anaerobic and facultative microorganisms that might help to treat \_\_\_\_\_ present in the wastewater column.

- A. Organic suspended solid(s)
- B. Volatile fatty acid(s)
- C. Colloidal and dissolved solids
- D. None of the above

### Typical SWIS Performance

48. Results from numerous studies have shown that septic tanks (SWISs) achieve high removal rates of many pollutants of concerns with the notable exception of \_\_\_\_\_.

- A. Nitrogen
- B. Nitrate(s)
- C. Phosphorous and metals
- D. None of the above

49. Biochemical oxygen demand (BOD), suspended solids, fecal bacteria indicators and surfactants are effectively removed within \_\_\_\_\_ feet of unsaturated, aerobic soil.

- A. 2-5
- B. 1-4
- C. 2-6
- D. None of the above

50. Which of the following and metals are removed by adsorption, ion exchange and precipitation?
- A. Nitrogen
  - B. Nitrate(s)
  - C. Phosphorous
  - D. None of the above

### Septic Pretreatment Components

51. Which of the following remove many of the contaminants from the wastewater to prepare the effluent for final treatment and dispersal into the environment? The level of treatment is selected to match the receiving environment and the intended use.
- A. Pretreatment components
  - B. Advanced systems
  - C. Gravity flow systems
  - D. None of the above

52. Which of the following is reduced to a level the soil can accept and treat? Many options exist for treatment prior to release into the receiving environment.
- A. Advanced system(s)
  - B. Septic tank effluent
  - C. The quantity of contaminants
  - D. None of the above

### Cluster System Applications

53. A cluster system is designed to collect wastewater from \_\_\_\_\_ homes.
- A. Three to fifty
  - B. Two to one hundred
  - C. Two to several hundred
  - D. None of the above

54. The Cluster Wastewater Systems Planning Handbook lists a number of potential wastewater collection technologies for small and large cluster systems, including: grinder pump systems, which transport all sewage; effluent sewers, such as the \_\_\_\_\_; the septic tank effluent gravity (STEG) collection system; and vacuum systems.
- A. Septic tank effluent pump (STEP)
  - B. Individual and clustered systems
  - C. Infiltration area protection
  - D. None of the above

55. Treatment facilities serving clustered buildings may range from a communal septic tank and \_\_\_\_\_ to a more advanced treatment system.
- A. Soil dispersal system
  - B. Infiltration area protection
  - C. Individual and clustered systems
  - D. None of the above

### Septic System Failures

56. Which of the following failures are a major source of groundwater pollution?
- A. Soil dispersal system
  - B. Septic system
  - C. Individual and clustered systems
  - D. None of the above

57. Layers of soil act as a natural filter, removing microbes and other particles as water seeps through. Improperly treated water can carry \_\_\_\_\_ that can cause gastroenteritis, fever, common cold, respiratory infections and hepatitis.
- A. All sewage
  - B. Bacteria and viruses
  - C. Waterborne pollution
  - D. None of the above

58. Which of the following are effective, cost efficient, and easy to maintain?
- A. Septic tank effluent pump (STEP)
  - B. Individual and clustered systems
  - C. Septic systems
  - D. None of the above

59. Failing systems are a major source of groundwater pollution, cause \_\_\_\_\_, such as dysentery and hepatitis, and are expensive for homeowners to replace. There are many different types of wastewater collection and treatment technologies.

- A. Aerobic microsite(s)
- C. Chemical diseases
- B. Waterborne illnesses
- D. None of the above

60. Which of the following for clustered facilities can work by gravity or operate via vacuum or pressure pump?

- A. Septic system(s)
- C. Collection systems
- B. Cluster system(s)
- D. None of the above

### **Advanced (Tertiary) Systems Introduction**

61. Advanced systems can be designed and built on-site or can consist of prefabricated units designed to overcome some site and soil limitations including:

When the aerated (unsaturated) soil depth below the infiltrative surface in the drainfield is less than the minimum required, advanced treatment processes or components (e.g., \_\_\_\_\_) can be added to increase pollutant removal prior to soil discharge.

- A. Fixed film treatment units
- C. Infiltrative surface
- B. Septic tank effluent
- D. None of the above

62. Wastewater with high organic strength (e.g., from a restaurant) can employ \_\_\_\_\_ to improve aeration, biological decomposition, and treatment of organic wastes.

- A. Gravity flow systems
- C. Advanced treatment units/processes
- B. Septic tank effluent
- D. None of the above

63. Which of the following provide timed dosing of septic tank or treatment unit effluent to the soil can sometimes be used where soil infiltration areas are limited, except in cases of high-clay content soils?

- A. Advanced system(s)
- C. Pressurized distribution methods
- B. The dose/rest cycle
- D. None of the above

64. Advanced systems employ \_\_\_\_\_ can reduce bacteria and nutrient loading to groundwater by applying wastewater high in the soil profile, improving bacteria predation and uptake of nutrients by plants and providing a carbon source for denitrification.

- A. Nutrient loading
- C. Pressure drip dispersal of the effluent
- B. Modified dispersal area
- D. None of the above

### **Advanced Onsite Wastewater Treatment Systems and Components**

#### **Elevated (Mound or At-Grade) Systems**

65. Effluent flows from the tank or treatment unit to a pump tank and periodically dosed to the \_\_\_\_\_, which is typically constructed of a layer of clean, uniformly graded sand on a plowed or roughened natural soil surface.

- A. At-grade systems
- C. Modified dispersal area
- B. Sand dispersal field
- D. None of the above

66. The tank effluent is uniformly dosed onto the \_\_\_\_\_ within the mound, which may be 1-4 ft. above the natural grade. Sand within the mound compensates for shallow unsaturated soil conditions below the natural grade.

- A. Media filter(s)
- C. Infiltrative surface
- B. ATU(s)
- D. None of the above

### Mound Systems

67. Mound systems are appropriate for areas with a high water table or shallow, fractured bedrock. After treatment through the \_\_\_\_\_, the effluent percolates directly into the soil under the mound.

- A. Effluent dispersal piping
- B. Aerobic treatment units (ATUs)
- C. Sand
- D. None of the above

68. \_\_\_\_\_ feature effluent dispersal piping placed at natural grade, with the mound consisting mostly of cover soil for the piping.

- A. At-grade systems
- B. Aerobic treatment units (ATUs)
- C. Effluent flows from the tank
- D. None of the above

69. The mound should have inspection ports, so wastewater distribution across the infiltration area can be monitored. \_\_\_\_\_ should have cleanouts so they can be flushed at least twice a year.

- A. Media filter(s)
- B. ATU(s)
- C. Distribution lines
- D. None of the above

### Aerobic Treatment Units

70. \_\_\_\_\_) consist of prefabricated units featuring consecutive or compartmentalized tanks, pumps, blowers, and internal piping, and are designed to treat wastewater via suspended or attached growth decomposition in an oxygen rich environment.

- A. Effluent dispersal piping
- B. Aerobic treatment units (ATUs)
- C. Effluent flows from the tank
- D. None of the above

71. When \_\_\_\_\_ is supplied, the rate of microbial activity and related treatment processes accelerates.

- A. Nitrogen
- B. Oxygen
- C. Hydrogen
- D. None of the above

72. Three processes are involved in most \_\_\_\_\_: physical separation (mostly settling), aerobic treatment (aeration and mixing), and clarification (final settling).

- A. Media filter(s)
- B. Anaerobic systems
- C. Aerobic systems
- D. None of the above

73. \_\_\_\_\_ vary in design and can consist of simple activated sludge variations, sequencing batch reactors, trickling filters, and combinations of two or more of these unit processes.

- A. Media filter(s)
- B. ATU(s)
- C. Septic tank effluent
- D. None of the above

### Media Filters

74. \_\_\_\_\_ can be applied to a layer of sand or gravel, a tank containing peat or plastic media, or compartments of hanging textile or other material to improve oxygen access and enhance biochemical treatment processes.

- A. Media filter(s)
- B. ATU(s)
- C. Septic tank effluent
- D. None of the above

75. A number of these so-called “\_\_\_\_\_” are available to treat wastewater.

- A. Media filter(s)
- B. ATU(s)
- C. Septic tank effluent
- D. None of the above

76. Sand is the most commonly used \_\_\_\_\_, but clean gravel, crushed glass, textile strips, peat, and tire crumbs are also used, depending on site restrictions and state/local regulations.

- A. Media
- B. Septic tank effluent
- C. Soil dispersal field
- D. None of the above

77. In single-pass or intermittent filter (ISF) design, \_\_\_\_\_ is pump-dosed uniformly onto the media at regular intervals 12 to 48 times per day.

- A. Media
- B. Septic tank effluent
- C. Sand
- D. None of the above

## **ONSITE OPERATION AND MAINTENANCE SECTION**

### **System Operation and Maintenance Requirements**

78. When \_\_\_\_\_ exist, adjustments to the upstream treatment train may be needed to reduce biochemical oxygen demand, total suspended solids, bacteria levels, nutrients, or other pollutants.

- A. Groundwater pollution
- B. Hydraulic failures
- C. Soil limitations
- D. None of the above

79. Adjustments could involve reducing \_\_\_\_\_ at the source (e.g., better plate and pot scraping prior to dishwashing in restaurant kitchens, adding grease trap tanks, etc.), applying the effluent at lower soil loading rates, or inserting a fixed film or suspended growth treatment unit between the septic tank and drainfield.

- A. Septic system maintenance
- B. Failure(s)
- C. Pollutant inputs
- D. None of the above

### **Septic System Failures**

80. Septic system failures are a major source of \_\_\_\_\_.

- A. Groundwater pollution
- B. Hydraulic failures
- C. Failure(s)
- D. None of the above

81. \_\_\_\_\_ is like automobile maintenance; a little effort on a regular basis can save you a lot of money and significantly prolong the life of the system.

- A. Septic system maintenance
- B. Failure(s)
- C. Suspended growth treatment unit
- D. None of the above

82. Some soil-based systems (those with a drain field) are installed at sites with inadequate or inappropriate soils, excessive slopes, or high ground water tables. These conditions can cause hydraulic failures and \_\_\_\_\_.

- A. Groundwater pollution
- B. Contamination of nearby water sources
- C. Upstream treatment train
- D. None of the above

83. Failure to perform routine maintenance, such as pumping the septic tank generally at least every \_\_\_\_\_ years, can cause solids in the tank to migrate into the drain field and clog the system.

- A. 1 to 2
- B. 3 to 5
- C. 3 to 4
- D. None of the above

**Regular Maintenance**

84. Verification of \_\_\_\_\_ contracts, operator expertise, and reporting requirements for system maintenance such as tank pumping and repairs should be included in the approval process.
- A. Drainage features
  - B. Installation specifications
  - C. System maintenance
  - D. None of the above

**These records should reflect:**

85. If properly designed, installed, and maintained, a septic system can effectively treat household wastewater for up to \_\_\_\_\_ years or more. Look to see if the house has a system that is near the end of its life-span.
- A. 50
  - B. 30
  - C. 20
  - D. None of the above

86. Size is important because graywater (laundry water, sink water) and blackwater (toilet water) need to be retained in the tank for at least a \_\_\_\_\_ to allow solids to separate from the liquids and begin breaking down. If wastewater is pushed through without proper settling, the solids can clog the drainfield, stressing and possibly damaging the system.
- A. Day or more
  - B. 12 hours or more
  - C. Week or more
  - D. None of the above

**Individual Wastewater Systems**

87. Mechanical systems, such as activated sludge-based units, require servicing three to four times a year, while conventional systems need service or pumping every \_\_\_\_\_ years, depending on occupancy and use.
- A. 1 to 5
  - B. 3 to 5
  - C. 5 to 10
  - D. None of the above

**Septic System Evaluation Guideline**

**Enhanced Treatment Systems**

88. \_\_\_\_\_ have proven to be effective in situations where conventional systems are not appropriate.
- A. Treatment performance
  - B. Several wastewater alternative technologies
  - C. Wastewater treatment system(s)
  - D. None of the above

**Enhanced Wastewater Treatment**

89. Advanced or innovative technologies that provide a \_\_\_\_\_ beyond conventional systems. Generally, these systems have mechanical or moving parts that require periodic operation and maintenance, inspections, and eventual replacement.
- A. Clustered system(s)
  - B. O&M requirement(s)
  - C. Higher level of treatment
  - D. None of the above
90. Enhanced wastewater treatment systems are more complex than \_\_\_\_\_ and require greater oversight to keep all aspects of the treatment process in balance.
- A. Treatment performance
  - B. O&M requirement(s)
  - C. Conventional systems
  - D. None of the above

### Perforated Pipe

91. Perforated pipe is laid in the bottom of upslope trenches excavated into the restrictive horizon. A durable, porous medium is placed around the piping and up to a level above the estimated \_\_\_\_\_.

- A. Low-saturated zone
- B. An outfall for the drain
- C. Seasonally high-saturated zone
- D. None of the above

92. If the saturated hydraulic conductivity is low and the drainable porosity (the percentage of pore space drained when the soil is at field capacity) is small, even \_\_\_\_\_ might have limited effect on soil wetness conditions.

- A. SWIS
- B. Outlet locations
- C. Effectively designed curtain drains
- D. None of the above

### Inspections and Maintenance Requirements

93. A four-bedroom home might have a daily flow of 480 gallons per day (assuming 120 gallons per bedroom per day). In a 1,000-gallon tank, this provides \_\_\_\_\_ days for solids to settle.

- A. 2
- B. 3
- C. 4
- D. None of the above

94. Nevertheless, as the solids build up, there is less room in the tank for the liquid and thus less settling time. The accepted maximum level of solids in the tank is \_\_\_\_\_ of the liquid depth. Any more than this and the tank is overdue for pumping. Having these solids removed, is a critical component of how well the septic system, as a whole, will function.

- A. 1/2
- B. 1/3
- C. 1/4
- D. None of the above

### SWIS Designs

95. There are several different designs for \_\_\_\_\_. They include trenches, beds, seepage pits, at grade systems, and mounds.

- A. Seepage pits
- B. SWISs
- C. Secondary infiltrative surface
- D. None of the above

96. An important difference between infiltration surfaces constructed in natural soil and those constructed in fill material is that a secondary infiltrative surface (which must be considered in design) is created at the \_\_\_\_\_.

- A. Fill/natural soil interface
- B. Infiltration surface
- C. Secondary infiltrative surface
- D. None of the above

### Maintenance Inspections

97. Maintenance inspections are gaining appeal as a management tool to assess the condition of systems and determine pumping or \_\_\_\_\_.

- A. Other O&M needs
- B. Advances in technology
- C. Alternative and enhanced wastewater technologies
- D. None of the above

98. Some local agencies have adopted a sewage management program that requires the annual inspection of systems with newly issued or modified permits and proof of \_\_\_\_\_ for all systems (old and new).

- A. Septic tank pumping
- B. Advances in technology
- C. Operation and maintenance inspection programs
- D. None of the above

99. \_\_\_\_\_ are usually coupled with a mandatory septic tank pumping program. The local agency notifies the system owner when pumping is due. Verification of pumping is provided to the regulating agency.

- A. Septic tank pumping
- B. Advances in technology
- C. Operation and maintenance inspection programs
- D. None of the above

100. Typical pumping requirements vary from three to five years or more based on the \_\_\_\_\_ and individual household wastewater characteristics.

- A. Typical pumping requirement(s)
- B. Enhanced system(s)
- C. Daily sewage flow
- D. None of the above

### Standard Leach Field Septic System Inspection

101. As the septic system is used, there is an accumulation of solids in the tank, which is sometime referred to as \_\_\_\_\_.

- A. Slime
- B. Sludge
- C. Long-term biochemical oxygen demand
- D. None of the above

102. The septic tank removes solids by holding wastewater in the tank for at least 24 hours, allowing the \_\_\_\_\_ to settle and \_\_\_\_\_ to rise to the top. This is accomplished by a series of baffles inside the tank.

- A. Scum - Solids
- B. Sludge - Scum
- C. Solids - Scum
- D. None of the above

103. Up to \_\_\_\_\_% of the solids retained in the tank will decompose over time.

- A. 25
- B. 50
- C. 40
- D. None of the above

104. Effluent water discharges from the tank to perforated drain pipes. From there, it drains to a \_\_\_\_\_.

- A. Constructed absorption or leach field
- B. Leach fields or leach drains
- C. A septic tank, the septic drain field
- D. None of the above

105. Septic drain fields, also called leach fields or leach drains are used to remove contaminants and impurities from the liquid that emerges from \_\_\_\_\_.

- A. Effluent water discharges
- B. Leach fields or leach drains
- C. The septic tank
- D. None of the above

106. A septic tank, the septic drain field, and the associated piping compose \_\_\_\_\_.

- A. Effluent water discharges
- B. Leach fields or leach drains
- C. A complete septic system
- D. None of the above

107. \_\_\_\_\_ is effective for disposal of organic materials readily catabolized by a microbial ecosystem.

- A. Effluent water discharges
- B. Leach fields or leach drains
- C. The septic drain field
- D. None of the above

108. \_\_\_\_\_ typically consists of an arrangement of trenches containing perforated pipes and porous material (often gravel) covered by a layer of soil to prevent animals and surface runoff from reaching the wastewater distributed within those trenches.

- A. Effluent water discharges
- B. The drain field
- C. A trench
- D. None of the above

109. Primary design considerations are hydraulic for the \_\_\_\_\_ requiring disposal and catabolic for the long-term biochemical oxygen demand of that wastewater.  
A. Septic tank effluent                      C. Insoluble particles small enough  
B. Volume of wastewater                      D. None of the above

110. Microbial colonies catabolizing \_\_\_\_\_ from the septic tank effluent will adhere to soil particles and reduce the interstitial area available for water flow between soil particles. These colonies tend to form a low-permeability biofilm of gelatinous slime at the soil interface of the disposal trench  
A. Soluble organic compounds      C. Insoluble particles small enough  
B. Wastewater                                  D. None of the above

### **Biomat**

111. A properly functioning \_\_\_\_\_ will have wastewater ponded in the distribution media while the soil a few inches outside of and below the distribution media will be unsaturated.  
A. Gravity-fed system      C. Unsaturated flow  
B. Soil system                      D. None of the above

112. Unsaturated soil has pores containing both air and water so aerobic microorganisms living in the soil can effectively treat the wastewater as it travels through the \_\_\_\_\_.  
A. Gravity-fed system      C. Unsaturated flow  
B. Soil system                      D. None of the above

113. In unsaturated soil under a biomat, \_\_\_\_\_ is restricted.  
A. Water movement      C. Unsaturated flow  
B. Bacteria                      D. None of the above

### **Sewage Treatment Utilizing Soil**

114. A developed biomat reaches \_\_\_\_\_ over time, remaining at about the same thickness and the same permeability if effluent quality is maintained.  
A. Equilibrium                      C. Permeability of the biomat  
B. Quality of the effluent      D. None of the above

115. For equilibrium to be maintained, the biomat and the effluent ponded within the trench must be in \_\_\_\_\_, the organic materials in the wastewater feed the anaerobic microorganisms, which grow and multiply, increasing the thickness and decreasing the permeability of the biomat.  
A. Equilibrium                      C. Permeability of the biomat  
B. Anaerobic conditions      D. None of the above

### **Site Evaluations**

116. Site evaluations are a key driver of treatment system design. The success of any soil-discharging wastewater treatment system depends on the appropriate match between \_\_\_\_\_, the treatment system design, and the site that receives effluent from the system.  
A. Site-specific                      C. Wastewater flow/strength  
B. Quality of the effluent      D. None of the above

### Assure System Performance

117. The subsurface “ponding” and slow release of effluent to the soil through the biomat facilitates treatment via chemical, physical, and biological processes such as \_\_\_\_\_, adsorption of potential pollutants (e.g., phosphorus), filtration of solids, and decomposition of organic constituents.

- A. Clustered wastewater system(s)
- B. Equilibrium
- C. Aerobic nitrification of ammonia
- D. None of the above

118. Predicting the \_\_\_\_\_ and overall treatment efficacy of the soil component of the system requires a fairly comprehensive understanding of how these processes work, how they are enhanced or impeded, and how the upstream processes in the treatment train can be adjusted or adapted to ensure that the soil can handle the flow and pollutant load delivered.

- A. Final treatment of effluent
- B. Wastewater flow/strength
- C. Pollutant removal
- D. None of the above

### Improving OSSF Treatment through Performance Requirements

119. Most onsite wastewater treatment systems are of the conventional type, consisting of a septic tank and a \_\_\_\_\_.

- A. Regular maintenance
- B. Site limitations
- C. Subsurface wastewater infiltration system (SWIS)
- D. None of the above

120. \_\_\_\_\_ can be expressed as numeric criteria (e.g., pollutant concentration or mass loading limits) or narrative criteria (e.g., no odors or visible sheen) and are based on the assimilative capacity of regional ground water or surface waters, water quality objectives, and public health goals.

- A. Performance requirements
- B. Water resources
- C. Primary and secondary processes
- D. None of the above

121. \_\_\_\_\_ help define system design and size and can be estimated by comparing the size and type of facility with measured effluent outputs from similar, existing facilities.

- A. Existing technologies
- B. Wastewater flow and pollutant content
- C. Wastewater characteristics and site conditions
- D. None of the above

122. \_\_\_\_\_ applied today treat wastes after they exit the septic tank; the tank retains settleable solids, grease, and oils and provides an environment for partial digestion of settled organic wastes.

- A. Regular maintenance
- B. Septic system
- C. Most of the alternative treatment technologies
- D. None of the above

123. Post-tank treatment can include aerobic (with oxygen) or anaerobic (with no or low oxygen) biological treatment in suspended or fixed-film reactors, physical/chemical treatment, soil infiltration, \_\_\_\_\_.

- A. Fixed-media filtration, and/or disinfection
- B. Water resources
- C. Primary and secondary processes
- D. None of the above

### Performance-Based Standards

124. The move toward site-appropriate, risk-based system design and the growing interest in \_\_\_\_\_ has increased the need for performance-based design guidance.

- A. Performance requirements
- B. Clustered facilities
- C. Primary and secondary processes
- D. None of the above

### System Design Considerations

125. One of the more common reasons why some individual or cluster systems do not perform properly is inappropriate \_\_\_\_\_ selection.

- A. System/technology
- B. Subsurface drainfield(s)
- C. System compatibility
- D. None of the above

126. A wastewater system should be matched to the volume and \_\_\_\_\_, and the site, soil, and groundwater/surface water conditions must be known in detail in order to develop an appropriate system design.

- A. Alternative treatment technologies
- B. Wastewater flow and pollutant content
- C. Pollutant profile of wastewater
- D. None of the above

127. \_\_\_\_\_ permitting programs are expanding the options available for providing treatment services, especially for sites with limiting soil conditions and those with threatened or impaired water resources nearby.

- A. Regular maintenance
- B. Septic system
- C. State and local wastewater system
- D. None of the above

### Management Considerations

128. All \_\_\_\_\_ systems require management. Management services can be provided by an outside contractor or responsible management entity.

- A. System/technology
- B. Subsurface drainfield(s)
- C. Wastewater treatment
- D. None of the above

129. In general, \_\_\_\_\_ with septic tanks and subsurface drainfields require less management attention; clustered facilities with collection system pumps, mechanized treatment units, and time or demand-dosed infiltration areas require much more.

- A. System/technology
- B. Subsurface drainfield(s)
- C. Individual gravity flow systems
- D. None of the above

130. Factors that influence system management include:

- \_\_\_\_\_, such as very cold or wet climates.
- A. Complexity of service
  - B. All system components
  - C. Operation in extreme conditions
  - D. None of the above

131. \_\_\_\_\_ and access to repair parts.

- A. Soil condition(s)
- B. Subsurface drainfield(s)
- C. Life of system components
- D. None of the above

132. Maintenance needs, including frequency and \_\_\_\_\_.

- A. Complexity of service
- B. Final design components
- C. Very cold or wet climates
- D. None of the above

### Permitting and Approval Process

133. It is important that the application include \_\_\_\_\_, narratives, forms, calculations, catalog cuts, photos, and other data, including detailed equipment and installation specifications to make siting the system components easier.

- A. System drawings
- B. Installation specifications
- C. System maintenance
- D. None of the above

134. If the site has been developed, all structures, utilities, and \_\_\_\_\_ should be identified.

- A. Regular maintenance
- C. Ingress and egress pathways
- B. Septic system
- D. None of the above

135. The source of potable water and distribution lines should be identified as well. If there is an existing wastewater treatment system, the condition of all components, including the reserve area, should be recorded and \_\_\_\_\_.

- A. System location and features
- C. Minimum setbacks met
- B. Installation specifications
- D. None of the above

### Summary

#### OSSF Maintenance

136. \_\_\_\_\_ can add years to an older system. Even well-designed and properly installed septic systems can fail earlier than expected if previous homeowners did not perform routine maintenance.

- A. Proper maintenance
- C. Septic tank or ATU
- B. Necessary pumping frequency
- D. None of the above

137. Try to determine how frequently the tank has been pumped from the realty agent or owner. Ask to see maintenance records. Keep in mind the necessary pumping frequency depends on the size of the household and the size of the \_\_\_\_\_.

- A. Sand/media filter(s)
- C. Onsite system
- B. Tank
- D. None of the above

138. For example, a four-bedroom home with a 1,250 gallon tank should be pumped approximately every \_\_\_\_\_ years. Modern conveniences such as garbage disposals, hot tubs, or whirlpools will increase the necessary pumping frequency.

- A. 3
- C. 2.6
- B. 4.5
- D. None of the above

#### Permit

139. Several factors should be considered when choosing the type of onsite system for a site including: soil/site limitations, available space, operation and maintenance (O & M) requirements, initial costs as well as \_\_\_\_\_, landscape disturbance, and the owners' preferences and ability to manage the system.

- A. Soil resource
- C. O & M costs
- B. Type of human sewage
- D. None of the above

140. Of these considerations, often the most limiting is the \_\_\_\_\_ or site and space limitations.

- A. Soil resource
- C. O & M costs
- B. Type of human sewage
- D. None of the above

**(s) means the answer may be plural or singular in nature.**

## **SUBSURFACE WASTEWATER INFILTRATION CONSTRUCTION SECTION**

### **Construction Section**

141. Correct wastewater treatment system construction and/or installation practices are critical to the performance of individual and \_\_\_\_\_.

- A. Pressure distribution
- B. Declustered systems
- C. Clustered systems
- D. None of the above

142. Construction actions can affect short-term and long-term system performance by failing to adhere to \_\_\_\_\_, neglecting proper pipe slope requirements, inadvertently switching tank inlet/outlet orientation, or failing to protect infiltration area soils from equipment compaction.

- A. Inlet/outlet orientation
- B. Material specifications
- C. Uphill dispersal piping
- D. None of the above

143. Which of the following is a key component of good system installation practice, should be carefully considered during site preparation, construction equipment selection and use, and before and during construction?

- A. Pressure distribution
- B. Infiltration area protection
- C. Individual and declustered systems
- D. None of the above

145. The development of a final design plan that includes drawings, narratives, forms, calculations, photos, and other data, including \_\_\_\_\_, will help ensure a successful outcome.

- A. Infiltration area
- B. Inlet/outlet orientation
- C. Detailed equipment and installation specifications
- D. None of the above

144. This information must be assembled into a cohesive document to allow the proper installation of the design without the need for any assumptions.

- A. True
- B. False

### **Background and Use of Onsite Wastewater Treatment Systems**

146. Only about \_\_\_\_\_ of the land area in the United States has soils suited for conventional subsurface soil absorption fields.

- A. 10 percent
- B. 1/3
- C. 1/4
- D. None of the above

147. Which of the following discharged into surface waters directly or through subsurface flows can spur algal growth and lead to eutrophication and low dissolved oxygen in lakes, rivers, and coastal areas?

- A. Nitrates and phosphorus
- B. Phosphorus compounds
- C. Contaminants
- D. None of the above

### **Septic Site Preparation and Excavation Practices**

148. Overhead power lines, steep slopes, and excavations at the installation site can all present serious \_\_\_\_\_.

- A. Safety hazard(s)
- B. Disturbance(s)
- C. Excavation(s)
- D. None of the above

149. A brief preconstruction meeting can ensure that \_\_\_\_\_ and practices to eliminate, minimize, or respond to them are identified.

- A. Safety hazard(s)
- B. Disturbance
- C. Excavation(s)
- D. None of the above

150. Site preparation requires a number of activities including clearing and surface preparation for filling. Use of lightweight tracked equipment will minimize soil \_\_\_\_\_.

- A. Compaction    C. Excavation
- B. Infiltration    D. None of the above

151. Soil \_\_\_\_\_ should be determined to ensure that it is dry, and care should be taken to avoid soil disturbance as much as possible.

- A. Compaction    C. Excavation
- B. Moisture        D. None of the above

152. To avoid potential soil damage during construction, the soil below the proposed infiltration surface elevation must be below its \_\_\_\_\_ during construction (i.e., it must lack the moisture required to make it moldable into stable shapes). This should be tested before excavation begins.

- A. Compaction    C. Excavation
- B. Plastic limit    D. None of the above

153. Site \_\_\_\_\_ is conducted only when the infiltration surface can be covered the same day to avoid loss of soil permeability from wind-blown silt or raindrop impact.

- A. Compaction    C. Excavation
- B. Plastic limit    D. None of the above

154. \_\_\_\_\_ and areas for traffic lanes, material stockpiling, and equipment parking should be designated on the drawings for the contractor.

- A. Site access points    C. Excavation
- B. Disturbance            D. None of the above

155. Flagging off the \_\_\_\_\_ area as early as possible is critical to ensure long-term function of the system.

- A. Compaction    C. Excavation
- B. Infiltration     D. None of the above

156. Grubbing of the site (mechanically raking away roots) should be avoided. If the site is to be filled, the surface should be moldboard- or chisel-plowed parallel to the contour (usually to a depth of seven to ten inches) when the soil is sufficiently dry to ensure maximum vertical \_\_\_\_\_.

- A. Compaction    C. Permeability
- B. Infiltration     D. None of the above

157. The organic layer should not be removed. Scarifying the surface with the teeth of a backhoe bucket is not sufficient. All efforts should be made to avoid any disturbance to the exposed \_\_\_\_\_ surface.

- A. Moisture        C. Infiltration
- B. Disturbance    D. None of the above

**Field Construction Practices**

158. Changes in construction practices over the past 25 years have led to improvements in the performance of \_\_\_\_\_.

- A. Individual wastewater system(s)    C. Long-term system performance
- B. System design                            D. None of the above

159. \_\_\_\_\_ in infiltration trenches should be scarified and the surface gently raked prior to installing the gravel or gravel-less piping/chambers.

- A. Compaction
- B. Smearred soil surfaces
- C. Excavation
- D. None of the above

160. If gravel or crushed rock is to be used for the system medium, the rock should be placed in the trench by using the backhoe bucket to \_\_\_\_\_.

- A. Individual wastewater system(s)
- B. System design
- C. Long-term system performance
- D. None of the above

### Project Execution

161. Ensure that \_\_\_\_\_ effluent dispersal holes go on the bottom.

- A. Site component location(s)
- B. Gravity flow system(s)
- C. Distribution pipe
- D. None of the above

162. Extend \_\_\_\_\_ piping stubs below tank access ports, but do not block ports to ensure access for pumping and inspection. Use rubber boots or grout to completely seal around pipes and risers.

- A. Inlet/outlet
- B. Distribution pipe effluent
- C. Uphill dispersal piping
- D. None of the above

163. Install access \_\_\_\_\_ to the surface, install outlet filters/screens, and complete installation of pumps, wiring, control panels, and other components.

- A. Port risers
- B. Gravity flow system(s)
- C. Gravity flow pipe(s)
- D. None of the above

164. Install \_\_\_\_\_ in key locations (near building sewer, D-box, etc.); this aids in operation/maintenance later on.

- A. Infiltration area
- B. Inlet/outlet orientation
- C. Cleanouts and inspection ports
- D. None of the above

### Soil Texture

Identify the missing term.

165. When moist, a thin ribbon or 1/8 inch or smaller wire formed between thumb and finger will withstand considerable movement and deformation.

- A. Sand
- B. Loamy Sand
- C. Silty Clay
- D. None of the above

166. Consists of large amounts of clay and moderate to small amounts of sand and silt. It breaks into very hard clods or lumps when dry. When moist, a thin, long ribbon or 1/16-inch wire can be molded with ease. Fingerprints will show on the soil, and a dull to bright polish is made on the soil by a shovel.

- A. Silt Loam
- B. Clay
- C. Loam
- D. None of the above

167. Consists of an even mixture of the different sizes of sand and of silt and clay. It is easily crumbled when dry and has a slightly gritty, yet fairly smooth feel. It is slightly plastic.

- A. Silt Loam
- B. Clay
- C. Loam
- D. None of the above

168. Consists of a moderate amount of fine grades of sand, a small amount of clay, and a large quantity of silt particles. Lumps in a dry, undisturbed state appear quite cloddy, but they can be pulverized readily; the soil then feels soft and floury.

- A. Silt Loam      C. Loam
- B. Clay            D. None of the above

169. When wet, \_\_\_\_\_ runs together in puddles. Either dry or moist, casts can be handled freely without breaking. When a ball of moist soil is passing between thumb and finger, it will not press out into a smooth, unbroken ribbon but will have a broken appearance.

- A. Silt Loam      C. Loam
- B. Clay            D. None of the above

170. Consists of an even mixture of sand, silt, and clay that breaks into clods or lumps when dry. When a ball of moist soil is pressed between the thumb and finger, it will form a thin ribbon that will readily break, barely sustaining its own weight. The moist soil is plastic and will form a cast that will withstand considerable handling.

- A. Clay Loam      C. Loam
- B. Clay            D. None of the above

171. Consists of even amounts of silt and clay and very small amounts of sand. It breaks into hard clods or lumps when dry.

- A. Sand            C. Silty Clay
- B. Loamy Sand    D. None of the above

172. Squeezed in the hand when dry, it will form a cast that will withstand careful handling. The cast formed of moist soil can be handled freely without breaking.

- A. Silt Loam      C. Loam
- B. Clay            D. None of the above

### **Percolation Tests**

173. A percolation test consists of digging one or more holes in the soil of the proposed dispersal field to a specified depth, presoaking the holes by maintaining a high water level in the holes, then completing the test by filling the holes to a specific level and timing and \_\_\_\_\_ as the water percolates into the surrounding soil.

- A. Allowable hydraulic loading rates                      C. An inappropriately high loading rate
- B. Measuring the water level drop                              D. None of the above

174. A percolation test has limitations. The test does not reveal limiting conditions in the soil profile and can provide \_\_\_\_\_, leading to an inappropriately high loading rate.

- A. Allowable hydraulic loading rates                      C. False readings during dry conditions
- B. Specific level and timing                                      D. None of the above

175. States and communities once relied solely on these tests to determine \_\_\_\_\_.

- A. Critical factors                      C. Effluent application rate(s)
- B. Percolation test(s)                D. None of the above

**(s) means the answer may be plural or singular in nature.**

**Perc Condition Terms Associated with Saturation**

176. The stripped areas and trans-located oxides or organic matter form a diffuse splotchy pattern of two or more colors.

- A. Dark Colored Shrink-Swell Soils
- B. Salt-Affected Soils
- C. Iron Stripping and Staining in Sandy Soils
- D. None of the above

177. Soils in arid and semi-arid areas that have visible accumulations of soluble salts at or near the ground surface.

- A. Dark Colored Shrink-Swell Soils
- B. Salt-Affected Soils
- C. Iron Stripping and Staining in Sandy Soils
- D. None of the above

178. Vertisols whose colors have values of 3 or less and chromas of 1 or less. Iron concentrations may be present but are not diagnostic of conditions associated with saturation.

- A. Dark Colored Shrink-Swell Soils
- B. Salt-Affected Soils
- C. Iron Stripping and Staining in Sandy Soils
- D. None of the above

179. Means soil morphological properties that may indicate the presence of a water table that persists long enough to impair system function and create a potential health hazard.

- A. Conditions Associated with Saturation
- B. Dark Colored Soils with Organic Matter Accumulation
- C. Depleted Matrix without Iron Concentrations
- D. None of the above

180. Soil horizons whose matrix chroma is 3 or more in which there are some visible iron depletions having a value 4 or more and a chroma of 2 or less. Iron-manganese concentrations as soft masses or pore linings may be present but are not diagnostic of conditions associated with saturation.

- A. High Chroma Matrix with Iron Depletions
- B. Depleted Matrix with Iron Concentrations
- C. Depleted Matrix without Iron Concentrations
- D. None of the above

181. Soil horizons whose color has a value of 4 or more and a chroma of 2 or less with hues that are often, but not exclusively, on the grey pages of the Munsell Color Book. On exposure to air, yellow colors form within 24 hours as some of the ferrous iron oxidizes.

- A. Dark Colored Shrink-Swell Soils
- B. Salt-Affected Soils
- C. Reduced Matrix
- D. None of the above

182. The upper surface layer has a dark color with a value of 3 or less and a chroma of 1 or less immediately underlain by a layer with a chroma of 2 or less.

- A. Dark Colored Shrink-Swell Soils
- B. Salt-Affected Soils
- C. Soils with a Dark Surface
- D. None of the above

183. Soil horizons in which iron/manganese oxides or organic matter or both have been stripped from the matrix, exposing the primary base color of soil materials.
- A. Dark Colored Shrink-Swell Soils
  - B. Salt-Affected Soils
  - C. Iron Stripping and Staining in Sandy Soils
  - D. None of the above

**Septic Tank Construction Considerations**

184. Important construction considerations include tank location, bedding and backfilling, watertightness, and \_\_\_\_\_, especially with non-concrete tanks.
- A. Wicking
  - B. Watertightness
  - C. Flotation prevention
  - D. None of the above

**Construction Materials**

185. Septic tanks smaller than \_\_\_\_\_ gallons are typically pre-manufactured; larger tanks are constructed in place.

- A. 6,000
- B. 12,000
- C. 10,000
- D. None of the above

186. Tanks constructed of fiberglass/reinforced polyester (FRP) usually have a wall thickness of about 1/4 inch (6 millimeters). Most are gel or resin coated to provide a smooth finish and prevent glass fibers from becoming exposed, which can cause \_\_\_\_\_.

- A. Wicking
- B. Watertightness
- C. Cracking or collapsing
- D. None of the above

187. Polyethylene tanks are more flexible than FRP tanks and can \_\_\_\_\_ if not properly designed.

- A. Deform to a shape of structural weakness
- B. Deform to watertightness
- C. Deform to cracking or collapsing
- D. None of the above

188. Some plastics (e.g., polyvinyl chloride, polyethylene, but not nylon) are virtually unaffected by \_\_\_\_\_.

- A. Acids and hydrogen sulfide
- B. Watertightness
- C. Cracking or collapsing
- D. None of the above

189. Tanks must be properly designed, reinforced, and constructed of the proper mix of materials so they can meet \_\_\_\_\_.

- A. Wicking
- B. Watertightness
- C. Anticipated loads without cracking or collapsing
- D. None of the above

190. All joints must be \_\_\_\_\_ to accommodate soil conditions. For concrete tank manufacturing, a "best practices manual" can be purchased from the National Pre-Cast Concrete Association (NPCA, 1998).

- A. Sealed properly
- B. Clean and dry
- C. Watertight and flexible
- D. None of the above

**(s) means the answer may be plural or singular in nature.**

### **Watertightness**

191. Leaks, whether exfiltrating or infiltrating, are serious. \_\_\_\_\_ of clear water to the tank from the building storm sewer or ground water adds to the hydraulic load of the system and can upset subsequent treatment processes.

- A. Exfiltration
- B. Watertightness
- C. Infiltration
- D. None of the above

### **Location**

192. The tank should be located where it can be accessed easily for septage removal and sited away from \_\_\_\_\_ where water can collect. Local codes must be consulted regarding minimum horizontal setback distances from buildings, property boundaries, wells, water lines, and the like.

- A. Imported granular material
- B. High organic content
- C. Drainage swales or depressions
- D. None of the above

### **Bedding and Backfilling**

193. The tank should rest on \_\_\_\_\_. It is good practice to provide a level, granular base for the tank. The underlying soils must be capable of bearing the weight of the tank and its contents.

- A. Tank and its contents
- B. A uniform bearing surface
- C. Shape and material of the tank
- D. None of the above

194. The backfill material should be free-flowing and free of stones larger than \_\_\_\_\_ inches in diameter, debris, ice, or snow. It should be added in lifts and each lift compacted.

- A. 2
- B. 3
- C. 4
- D. None of the above

### **Flotation Prevention**

195. If the tank is set where the soil can be saturated, tank flotation may occur, particularly when the tank is empty (e.g., recently pumped dose tanks or septic tank after septage removal). Tank manufacturers should be consulted for \_\_\_\_\_.

- A. Tank and its contents
- B. Appropriate anti-flotation devices
- C. Shape and material of the tank
- D. None of the above

### **Placement of the Infiltration Surface**

196. Placement of a SWIS infiltration surface may be below, at, or \_\_\_\_\_ (in an in-ground trench, at grade, or elevated in a mound system).

- A. Original soil profile
- B. SWIS infiltration surface
- C. Above the existing ground surface
- D. None of the above

### **Separation Distance from a Limiting Condition**

197. Placement of the infiltration surface in the soil profile is determined by \_\_\_\_\_.

- A. Infiltration surface in the soil profile
- B. Treatment and hydraulic performance requirements
- C. An adequate hydraulic gradient across the infiltration zone
- D. None of the above

198. Most current onsite wastewater system codes require minimum separation distances of at least \_\_\_\_\_ inches from the seasonally high water table or saturated zone irrespective of soil characteristics.

- A. 18
- B. 12 to 24
- C. 12 to 14
- D. None of the above

199. Generally, \_\_\_\_\_ foot separation distances have proven to be adequate in removing most fecal coliforms in septic tank effluent.

- A. 8 -12
- B. 2 to 8
- C. 2 to 4
- D. None of the above

200. A few studies have shown that separation distances of \_\_\_\_\_ inches are sufficient to achieve good fecal coliform removal if the wastewater receives additional pretreatment prior to soil application.

- A. 12 to 18
- B. 12 to 24
- C. 12 to 14
- D. None of the above