

**Registration form**

**GROUNDWATER PRODUCTION \$200.00  
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

**Start and Finish Dates:** \_\_\_\_\_

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

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

**Name** \_\_\_\_\_ **Signature** \_\_\_\_\_

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

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

Water Distribution  Water Treatment  Other \_\_\_\_\_

**Technical Learning College TLC PO Box 3060, Chino Valley, AZ 86323**

**Toll Free (866) 557-1746 Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)**

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## **DISCLAIMER NOTICE**

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**State Approval Listing Link**, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. If the course is not accepted for CEU credit, we will give you the course free if you ask your State to accept it for credit.

## **State Approval Listing URL...**

<http://www.abctlc.com/downloads/PDF/CEU%20State%20Approvals.pdf>

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## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

## **Rush Grading Service**

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

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

# Texas Students Only

## Acknowledgement of Notice of Potential Ineligibility for License

*You are required to sign and return to TLC or your credit will not be reported.*

Name: \_\_\_\_\_

Date of Birth: \_\_\_\_\_

Email Address: \_\_\_\_\_

By signing this form, I acknowledge that Technical Learning College notified me of the following:

- the potential ineligibility of an individual who has been convicted of an offense to be issued an occupational license by the Texas Commission on Environmental Quality (TCEQ) upon completion of the educational program;
- the current TCEQ Criminal Conviction Guidelines for Occupational Licensing, which describes the process by which the TCEQ's Executive Director determines whether a criminal conviction:
  - renders a prospective applicant an unsuitable candidate for an occupational license;
  - warrants the denial of a renewal application for an existing license; or
  - warrants revocation or suspension of a license previously granted.
- the right to request a criminal history evaluation from the TCEQ under Texas Occupations Code Section 53.102; and
- that the TCEQ may consider an individual to have been convicted of an offense for the purpose of denying, suspending or revoking a license under circumstances described in Title 30 Texas Administrative Code Section 30.33.

Enrollee Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name of Training Provider/Organization: Technical Learning College

Contact Person: Melissa Durbin Role/Title: Dean



# Texas TCEQ Important Information Changes

## Wastewater/Collections Rule Changes

### Rule Changes and Updates for Domestic Wastewater Systems

On Nov. 4, 2014, TCEQ commissioners adopted revisions to 30 Texas Administrative Code (TAC), Chapter 217, Design Criteria for Domestic Wastewater Systems, and “re-adopted” previously repealed rules in 30 TAC, Chapter 317, Design Criteria Prior to 2008.

#### ***Some of the changes to Chapter 217 include:***

- Adding new definitions and clarifying existing definitions;
- Adding design criteria and approval requirements for rehabilitation of existing infrastructure;
- Adding design criteria for new technologies, including cloth filters and air lift pumps;
- Making changes to reflect modern practices, standards and trends;
- Modifying rule language to improve readability and enforceability; and
- Modifying the design organic loadings and flows for a new wastewater treatment facility.

### **SUBCHAPTER A: ADMINISTRATIVE REQUIREMENTS §§217.1 - 217.18**

Effective December 4, 2015 §217.1. Applicability. (a) Applicability. (1) This chapter applies to the design, operation, and maintenance of: (A) domestic wastewater treatment facilities that are constructed with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (B) treatment units that are altered, constructed, or re-rated with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (C) collection systems that are constructed with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (D) collection system units that are altered, constructed, or re-rated with plans and specifications received and approved by the executive director after the effective date of the amendments to this chapter; (E) existing domestic wastewater treatment facilities that do not have a current Texas Pollutant Discharge Elimination System permit or a Texas Land Application Permit and are required to have an active wastewater permit; (F) existing wastewater treatment facilities and collection systems that never received approval for plans and specifications from the executive director; and (G) collection system rehabilitation projects covered in §217.56(c) and §217.69 of this title (relating to Trenchless Pipe Installation; and Maintenance, Inspection, and Rehabilitation of the Collection System). (2) Domestic wastewater treatment facilities, treatment units, collection systems, and collection system units with plans and specifications approved by the executive director that were received on or after August 28, 2008 and before the effective date of this chapter must comply with the rules in this chapter, as they existed immediately before the effective date of the amendments to this chapter.

The rules in Texas Commission on Environmental Quality Page 2 Chapter 217 - Design Criteria for Domestic Wastewater Systems effect immediately before the effective date of the amendments to this chapter are continued in effect for that purpose. (3) This chapter does not apply to: (A) the design, installation, operation, or maintenance of domestic wastewater treatment facilities, treatment units, collection systems, or collection system units with plans and specifications that were approved by the executive director on or before August 27, 2008, which are governed by Chapter 317 of this title (relating to Design Criteria Prior to 2008) or design criteria that preceded Chapter 317 of this title; and (B) systems regulated by Chapter 285 of this

title (relating to On-Site Sewage Facilities); or collection systems or wastewater treatment facilities that collect, transport, treat, or dispose of wastewater that does not have the characteristics of domestic wastewater, although the wastewater may contain domestic wastewater.

(b) The executive director may grant variances from new requirements added by the amendments of this chapter to a person who proposes to construct, alter, or re-rate a collection system or wastewater treatment facility if the plans and specifications for the project are submitted within 180 days after the date the amendments to this chapter are effective, provided the plans and specifications comply with the rules in effect immediately prior to the amendment. Adopted November 4, 2015 Effective December 4, 2015

**The link to the rules is available on the TCEQ website at <https://www.tceq.texas.gov/rules/indxpdf.html>**

***For Texas Students Only....***

**Please visit the TCEQ website and download all these rule changes and read and conform that you have understood these rule changes.**

Please sign and date this notice

Printed Name

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Signature

Date

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# Groundwater Production Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

Did you check with your State agency to ensure this course is accepted for credit?

You are responsible to ensure this course is accepted for credit.  
Method of Course acceptance confirmation. Please fill this section

Website \_\_\_ Telephone Call \_\_\_ Email \_\_\_ Spoke to \_\_\_\_\_

Did you receive the approval number, if applicable? \_\_\_\_\_

What is the course approval number, if applicable? \_\_\_\_\_

*You can electronically complete this assignment in Adobe Acrobat DC.*

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

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| 1. A B C D  | 18. A B C D | 35. A B C D | 52. A B C D |
| 2. A B C D  | 19. A B C D | 36. A B C D | 53. A B C D |
| 3. A B C D  | 20. A B C D | 37. A B C D | 54. A B     |
| 4. A B C D  | 21. A B C D | 38. A B     | 55. A B C D |
| 5. A B C D  | 22. A B C D | 39. A B C D | 56. A B     |
| 6. A B C D  | 23. A B C D | 40. A B C D | 57. A B     |
| 7. A B C D  | 24. A B C D | 41. A B C D | 58. A B C D |
| 8. A B C D  | 25. A B C D | 42. A B     | 59. A B     |
| 9. A B      | 26. A B     | 43. A B C D | 60. A B     |
| 10. A B     | 27. A B     | 44. A B C D | 61. A B C D |
| 11. A B C D | 28. A B C D | 45. A B C D | 62. A B C D |
| 12. A B C D | 29. A B C D | 46. A B C D | 63. A B C D |
| 13. A B     | 30. A B     | 47. A B C D | 64. A B C D |
| 14. A B C D | 31. A B C D | 48. A B C D | 65. A B C D |
| 15. A B     | 32. A B C D | 49. A B C D | 66. A B C D |
| 16. A B C D | 33. A B C D | 50. A B C D | 67. A B C D |
| 17. A B C D | 34. A B C D | 51. A B     | 68. A B C D |

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|--------------|--------------|--------------|--------------|
| 69. A B C D  | 102. A B     | 135. A B C D | 168. A B C D |
| 70. A B C D  | 103. A B C D | 136. A B C D | 169. A B C D |
| 71. A B C D  | 104. A B C D | 137. A B C D | 170. A B C D |
| 72. A B C D  | 105. A B C D | 138. A B C D | 171. A B C D |
| 73. A B C D  | 106. A B     | 139. A B     | 172. A B C D |
| 74. A B C D  | 107. A B     | 140. A B     | 173. A B C D |
| 75. A B C D  | 108. A B C D | 141. A B     | 174. A B C D |
| 76. A B C D  | 109. A B C D | 142. A B     | 175. A B C D |
| 77. A B C D  | 110. A B C D | 143. A B C D | 176. A B C D |
| 78. A B      | 111. A B C D | 144. A B C D | 177. A B C D |
| 79. A B C D  | 112. A B     | 145. A B C D | 178. A B C D |
| 80. A B      | 113. A B C D | 146. A B C D | 179. A B C D |
| 81. A B C D  | 114. A B C D | 147. A B C D | 180. A B     |
| 82. A B C D  | 115. A B C D | 148. A B C D | 181. A B     |
| 83. A B C D  | 116. A B C D | 149. A B C D | 182. A B C D |
| 84. A B      | 117. A B     | 150. A B C D | 183. A B     |
| 85. A B C D  | 118. A B C D | 151. A B     | 184. A B C D |
| 86. A B C D  | 119. A B C D | 152. A B     | 185. A B C D |
| 87. A B C D  | 120. A B C D | 153. A B     | 186. A B C D |
| 88. A B      | 121. A B C D | 154. A B C D | 187. A B     |
| 89. A B C D  | 122. A B     | 155. A B C D | 188. A B C D |
| 90. A B C D  | 123. A B     | 156. A B C D | 189. A B C D |
| 91. A B C D  | 124. A B C D | 157. A B C D | 190. A B C D |
| 92. A B      | 125. A B C D | 158. A B C D | 191. A B C D |
| 93. A B C D  | 126. A B C D | 159. A B C D | 192. A B C D |
| 94. A B C D  | 127. A B C D | 160. A B C D | 193. A B     |
| 95. A B C D  | 128. A B     | 161. A B C D | 194. A B C D |
| 96. A B C D  | 129. A B C D | 162. A B     | 195. A B C D |
| 97. A B C D  | 130. A B     | 163. A B C D | 196. A B C D |
| 98. A B C D  | 131. A B     | 164. A B C D | 197. A B C D |
| 99. A B C D  | 132. A B C D | 165. A B C D | 198. A B C D |
| 100. A B C D | 133. A B C D | 166. A B C D | 199. A B C D |
| 101. A B C D | 134. A B C D | 167. A B C D | 200. A B C D |



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

**GROUNDWATER PRODUCTION CEU COURSE  
CUSTOMER SERVICE RESPONSE CARD**

NAME: \_\_\_\_\_

E-MAIL \_\_\_\_\_ PHONE \_\_\_\_\_

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

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the subject matter on the exam to your actual field or work.

Very Similar 0 1 2 3 4 5 Very Different

How did you hear about this Course? \_\_\_\_\_

What would you do to improve the Course?

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Any other concerns or comments.

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

**Please fax the answer key to TLC Western Campus  
Fax (928) 272-0747**

Always call us after faxing the paperwork to ensure that we've received it.

**Rush Grading Service**

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00.

*This course contains general EPA's SDWA federal rule requirements. Please be aware that each state implements water / sampling procedures/ safety / environmental / SDWA regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to be in compliance with your regulatory agencies and do not follow this course for any compliance concerns.*

## Groundwater Production CEU Training Course Assignment

The Groundwater Production CEU course assignment is available in Word on the Internet for your convenience, please visit [www.abctlc.com](http://www.abctlc.com) and download the assignment and e-mail it back to TLC.

You will have 90 days from receipt of this manual to complete it in order to receive your Professional Development Hours (PDHs) or Continuing Education Unit (CEU). A score of 70 % or better is necessary to pass this course. If you should need any assistance, please email or fax all concerns and the completed ANSWER KEY to [info@tlch2o.com](mailto:info@tlch2o.com).

Select one answer per question. Please utilize the answer key. (s) on the answer will indicate either plural and singular tenses.

### Hyperlink to the Glossary and Appendix

<http://www.abctlc.com/downloads/PDF/WTGlossary.pdf>

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

## Groundwater Treatment/Production System Section

### Groundwater and Wells

- The level below which all the spaces in the ground are filled with water is called the?  
A. Unconfined aquifer(s)      C. Well(s)  
B. Water table                      D. None of the above
- The area above the water table lies the?  
A. Unsaturated zone              C. Saturated zone  
B. Karst                                  D. None of the above
- When toxic substances are spilled or dumped near a well, these can leach into \_\_\_\_\_ and contaminate the groundwater drawn from that well.  
A. Karst                                  C. Soil moisture  
B. Aquifer                              D. None of the above
- Which of the following flows slowly through water-bearing formations at different rates?  
A. Groundwater              C. Soil moisture  
B. Drinking water              D. None of the above
- The water in the saturated zone is called?  
A. Unconfined aquifer(s)      C. Water table  
B. Groundwater                      D. None of the above
- Which of the following are cracks, joints, or fractures in solid rock, through which groundwater moves?  
A. Fractured aquifer(s)          C. Soil moisture  
B. Karst                                  D. None of the above
- Limestone is often located in which of the following?  
A. Unconfined aquifer(s)      C. Fractured aquifer(s)  
B. Soil moisture                      D. None of the above

8. Which of the following may move in different directions below the ground than the water flowing on the surface?  
 A. Water table            C. Soil moisture  
 B. Groundwater        D. None of the above
9. Unconfined aquifers are those that are bounded by the water table. Some aquifers lie beneath layers of impermeable materials.  
 A. True            B. False
10. A well inside an aquifer is an artesian well.  
 A. True            B. False
11. Which of the following is the level to which the water in an artesian aquifer will rise?  
 A. Aquifer                    C. Water table  
 B. Piezometric surface    D. None of the above
12. Sandstone may become so highly cemented or recrystallized that all of the original space is filled, in this case, the rock is no longer a porous medium and is known as?  
 A. Unconfined aquifer(s)    C. Fractured aquifer(s)  
 B. Porous media            D. None of the above
13. Clay has many spaces between its grains, but the spaces are not large enough to permit free movement of water.  
 A. True            B. False
14. Which of the following usually flows downhill along the slope of the water table?  
 A. Groundwater            C. Soil moisture  
 B. Water table            D. None of the above

### **Cone of Depression**

15. When well pumping begins, water begins to flow towards the well in contrast to the natural direction of groundwater movement.  
 A. True            B. False
16. During pumping, the water level in the well falls below the water table in the?  
 A. Water table            C. Unconfined aquifer  
 B. Surrounding aquifer    D. None of the above
17. The movement of water from \_\_\_\_\_ into a well results in the formation of a cone of depression.  
 A. Confined aquifer        C. Water table  
 B. An aquifer            D. None of the above
18. Which of the following describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?  
 A. Water table            C. Cone of depression  
 B. Groundwater        D. None of the above
19. Which of the following is the vertical drop in the height between the water level in the well prior to pumping and the water level in the well during pumping?  
 A. Drawdown            C. Cone of depression  
 B. Groundwater        D. None of the above

20. When a water well is installed in \_\_\_\_\_, water moves from the aquifer into the well through small holes or slits in the well casing or, in some types of wells, through the open bottom of the well?
- A. Confined aquifer                      C. Water table  
B. An unconfined aquifer              D. None of the above

### Where Is Ground Water Stored?

21. If the aquifer is sandwiched between layers of comparatively impermeable materials, it is called?
- A. Confined aquifer                      C. Water table  
B. Unconfined aquifer                  D. None of the above
22. Which of the following are frequently found at greater depths than unconfined aquifers?
- A. Confined aquifer(s)                  C. Water table  
B. Unconfined aquifer(s)              D. None of the above
23. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, this term that literally means?
- A. Water table                          C. Cone of depression  
B. Water bearer                        D. None of the above
24. Which of the following stores water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?
- A. Water table                          C. Unconfined aquifer  
B. Aquifer(s)                            D. None of the above
25. Which of the following is regulated largely by its porosity, or the relative amount of open space present to hold water?
- A. Water table                            C. An aquifer's storage capacity  
B. Groundwater                         D. None of the above
26. There are two types of aquifers: confined and unconfined.
- A. True                                    B. False

### Does Groundwater Move?

27. Groundwater can move down only.
- A. True                                    B. False
28. Groundwater movement is in response to gravity, differences in elevation, and?
- A. Permeable zones                      C. Saturated zone  
B. Differences in pressure              D. None of the above
29. Groundwater can move even more quickly in karst aquifers, which are areas in \_\_\_\_\_ and similar rocks where fractures or cracks have been widened by the action of the ground water to form sinkholes, tunnels, or even caves?
- A. Karst aquifer(s)                      C. Water soluble limestone  
B. Saturated zone                        D. None of the above

### Groundwater Quality

30. The layers of soil and particles of sand, gravel, crushed rocks, and larger rocks were thought to act as filters, trapping contaminants before they could reach the ground water.
- A. True                                    B. False

31. It is known that some contaminants can pass through all of these filtering layers into \_\_\_\_\_ to contaminate ground water.

- A. Permeable zones
- B. Unsaturated zone
- C. Saturated zone
- D. None of the above

### How Does Ground Water Become Contaminated?

32. Groundwater contamination can begin on the surface of the ground, in the ground above the water table, or in the ground below the?

- A. Water table
- B. Ground water
- C. Permeable zones
- D. None of the above

33. If the contaminant is introduced straight into the area below \_\_\_\_\_, the primary process that can affect the impact of the contaminant is dilution by the surrounding ground water.

- A. Water table
- B. Saturated zone
- C. Unsaturated zone
- D. None of the above

### What Kinds of Substances Can Contaminate Groundwater, and Where Do They Come from?

34. Substances that can pollute \_\_\_\_\_ can be divided into two basic categories: substances that occur naturally and substances produced or introduced by man's activities.

- A. Synthetic organic chemical(s)
- B. Groundwater
- C. Permeable zones
- D. None of the above

35. A substantial number of today's groundwater contamination problems stem from man's activities and can be introduced into ground water from?

- A. Contaminant(s)
- B. Saturated zone
- C. A variety of sources
- D. None of the above

### Abandoned Wells

36. If which of the following if abandoned without being properly sealed, it can act as a direct channel for contaminants to reach ground water?

- A. A well
- B. Alternative sources of water
- C. Supplies of clean ground water
- D. None of the above

### What Can Be Done After Contamination Has Occurred?

37. Rehabilitate the \_\_\_\_\_ by either restraining or detoxifying the contaminants while they are still in the aquifer.

- A. Aquifer
- B. Contamination
- C. Supplies of clean ground water
- D. None of the above

### Water Well Reports and Hydrogeology Hydrogeologic Data

38. For hydrogeologists to make reliable assessments about the current and future status of ground water, they need to know where ground water occurs in the subsurface, what the properties are of the various geologic units below the surface, and how fast and in what direction ground water is moving.

- A. True
- B. False

### Nature of the Aquifer

39. An unconfined aquifer has the \_\_\_\_\_ as its upper surface; there are no significant low-permeability layers between the water table and the surface.

- A. Hydraulic head
- B. Water table
- C. Permeability area
- D. None of the above

40. According to the text, the top of the aquifer, can rise or fall depending on water use and amount of recharge to the aquifer and is called?
- A. Hydraulic head
  - B. Water table
  - C. Permeability zone
  - D. None of the above

41. Which of the following has a low-permeability geologic formation as its upper boundary?
- A. Hydraulic head
  - B. Water table
  - C. A confined aquifer
  - D. None of the above

### Hydraulic Head (h)

42. The hydraulic head is a measure of the water at a certain depth possesses because of its elevation and the pressure exerted through the weight of the water above it.
- A. True
  - B. False

43. Which of the following has units of feet, and generally parallels to the elevation of water in the well?
- A. Hydraulic head
  - B. Water table
  - C. Permeability zone
  - D. None of the above

### Permeability of the Aquifer (K)

44. Which of the following \_\_\_\_\_ or the permeability of the aquifer is a measure of how fast ground water can move through the aquifer?
- A. Hydraulic head
  - B. Hydraulic conductivity
  - C. Storage coefficient of the aquifer
  - D. None of the above

45. Which of the following has units of distance/time, e.g., feet/day, although it does not represent an actual speed?
- A. Hydraulic head
  - B. Hydraulic conductivity
  - C. Storage coefficient of the aquifer
  - D. None of the above

### In What Direction Is Groundwater Flowing?

46. The direction of groundwater flow is from higher to lower?
- A. Hydraulic head
  - B. Hydraulic conductivity
  - C. Storage coefficient of the aquifer
  - D. None of the above

47. Which of the following can be measured by lowering a probe through the observation port of a number of wells, all within the same relative time period?
- A. Hydraulic head
  - B. Hydraulic conductivity
  - C. Storage coefficient of the aquifer
  - D. None of the above

### What Is the Drawdown Associated with Pumping of a Well?

48. There is a relationship between the pumping rate of the well, the transmissivity of the aquifer, the distance between wells, \_\_\_\_\_, and the duration of the pumping event.
- A. Hydraulic head
  - B. Hydraulic conductivity
  - C. Storage coefficient of the aquifer
  - D. None of the above

### Depth to First Water-Bearing Zone

49. Some report the depth at which water is first encountered in?
- A. The drill hole
  - B. Static water level (SWL)
  - C. Recharge and discharge zone(s)
  - D. None of the above

(S) Means the answer can be plural or singular in nature

### Static Water Level

50. The driving force for ground water movement is the hydraulic head, and the \_\_\_\_\_ is a measure of that force.

- A. Hydrogeologic investigation(s)
- B. Static water level (SWL)
- C. Recharge and discharge zone(s)
- D. None of the above

51. Identifying where one aquifer ends and another begins is key to identifying the source of the yield for individual wells. Although this often can be determined by careful review of the lithologic log provided by the well constructor, the transition from one aquifer to the next can be indicated by a marked change in the recharge and discharge zones

- A. True
- B. False

52. Which of the following have important effects in groundwater protection and identifying the relation between area groundwater and local streams?

- A. Water-bearing zone(s)
- B. SWL
- C. Recharge and discharge zone(s)
- D. None of the above

53. Which of the following is a better gauge that a different aquifer has been encountered than the lithologic description?

- A. Water-bearing zone(s)
- B. SWL
- C. Recharge and discharge zone(s)
- D. None of the above

### Water-Bearing Zones

54. In some cases, the screened or perforated portions of cased wells provide a clue, but all too often, the screened interval is either significantly less than the actual static water level.

- A. True
- B. False

55. Arriving at accurate approximations of aquifer parameters or calculating ground water velocity requires us to know the thickness of the?

- A. Water-bearing zone(s)
- B. SWL
- C. Recharge and discharge zone(s)
- D. None of the above

### Lithologic Log

56. The well log portion of the well report describes what the driller encountered in the subsurface.

- A. True
- B. False

### Contributions of Well Constructors to Hydrogeology

57. The well report document stresses the importance of data that is recorded on well reports and how that data influences hydrogeologic investigations.

- A. True
- B. False

58. Well constructors can provide important inputs to the science by making careful observations and measurements when recording that data on the?

- A. Static water level
- B. Well report
- C. Local ground water systems
- D. None of the above

### How Wells Are Drilled

59. Drilling fluids are often used during drilling in order to keep the drill bit sharp while drilling is done.

- A. True
- B. False

(S) Means the answer can be plural or singular in nature



60. Typical drilling fluids are combinations of acids and iron compounds.  
A. True      B. False

### Basic Rotary Drilling Methods

61. Rotary drilling uses two methods that include: direct and reverse mud rotary, direct air rotary, and?  
A. Advanced methods      C. Drill through casing driver methods  
B. Typical drilling fluid(s)      D. None of the above

### The Rotary Drill String

62. Rotary drilling methods use a drill string, which typically consists of a bit, collar, drill pipe and?  
A. The drill collar      C. A kelly  
B. A Sub      D. None of the above

63. Which of the following is a section of heavy walled pipe that can be hexagonal, square, or rounded with grooves?  
A. The flighting      C. A kelly  
B. The plug      D. None of the above

64. Which of the following is several feet longer than the drill pipe being used and fits into the table drive much like the splines on a drive shaft fit into a transmission?  
A. The drill collar      C. The kelly  
B. The Sub      D. None of the above

65. Some rotary rigs use a top drive to turn \_\_\_\_\_ and are like a drill press.  
A. The drill collar      C. The drill string  
B. Drag bit(s)      D. None of the above

66. Drill pipe can be used in various lengths but are typically 20-foot sections and may be connected to the drive unit with?  
A. The drill collar      C. A kelly  
B. A Sub      D. None of the above

67. A sub is a length of pipe used to connect pipes and/or act as shock absorber (between the drill pipes and drive unit, at the end of the drill pipe is)?  
A. The drill collar      C. Shock absorber  
B. Drag bit(s)      D. None of the above

68. Which of the following or stabilizer is typically very heavy and is often gauged close to the diameter of the bit being used?  
A. The drill collar      C. Shock absorber  
B. Drag bit(s)      D. None of the above

69. Which of the following aids in maintaining a consistent borehole diameter and primarily helps to prevent borehole deviation?  
A. The drill collar      C. Shock absorber  
B. Drag bit(s)      D. None of the above

70. Several types of bits may be used; such as drag bits or?  
A. The flighting      C. Roller bits  
B. The plug      D. None of the above

(S) Means the answer can be plural or singular in nature

71. Which of the following are normally used in unconsolidated to semi-consolidated sand, silt, and clay-rich formations?

- A. The drill collar
- B. Drag bit(s)
- C. Roller bit(s)
- D. None of the above

72. Drag bits come in many shapes and sizes and cut with a shearing action aided by the jetting of drilling fluids from?

- A. The drill collar
- B. Nozzles or jets in the bit
- C. Shock absorber (floating sub)
- D. None of the above

73. Roller bits, such as \_\_\_\_\_, typically utilize interlocking teeth or buttons on individual rotating cones to cut, crush, or chip through the formation.

- A. The flighting
- B. The plug
- C. The common tri-cone bit
- D. None of the above

74. Roller bits can be used in consolidated formations and even hard rock applications if equipped with carbide buttons. These types of bits are often referred to as?

- A. Roller button bits
- B. The Kelly
- C. Reamers
- D. None of the above

75. Which of the following are bits that can be utilized to enlarge, straighten, or clean an existing borehole?

- A. Roller button bits
- B. The Kelly
- C. Reamers
- D. None of the above

76. Which of the following are used to enlarge deeper sections of an existing borehole without requiring the enlargement of the entire upper well bore?

- A. Cutting blades
- B. Under reamers
- C. Reamers
- D. None of the above

77. Under reaming involves the projection of \_\_\_\_\_ beneath permanently installed casing in loosely consolidated sediments.

- A. Cutting blades
- B. Under reamers
- C. Reamers
- D. None of the above

### **Direct Rotary Method**

78. Direct rotary drilling methods utilize a rotating bit at the end of a drilling string with drilling fluid that is circulated from the rig through the drill pipe and jets in the bit.

- A. True
- B. False

79. The drilling fluid that is pumped by \_\_\_\_\_ and/or air compressor is jetted out of ports in the bit.

- A. The drilling fluid
- B. The rig's mud pump
- C. The cutting's containment systems
- D. None of the above

80. The drilling fluid carries cuttings up the annular space between the drill pipe and formation and into mud pits or containment recirculating systems on the surface.

- A. True
- B. False

81. Which of the following pressurizes the borehole and helps to keep the hole open while removing cuttings?

- A. The drilling fluid
- B. The rig's mud pump
- C. The cutting's containment systems
- D. None of the above

82. Large drill rigs may utilize \_\_\_\_\_ that separate the cuttings from the drilling fluid before a pickup pump recirculates the drilling fluid back down the borehole, where the process is then repeated.  
A. The drilling fluid                      C. The cutting's containment systems  
B. The rig's mud pump                      D. None of the above

83. Mud pits may be dug into the ground adjacent to the rig in order to contain and settle out cuttings from \_\_\_\_\_ before recirculating.  
A. The flighting                              C. The drilling fluid  
B. The borehole                              D. None of the above

### **Direct Mud Rotary Method**

84. Mud is circulated down the drill string and through the bit at the bottom of the borehole and the mud then carries the cuttings generated by the bit up to the surface and into the mud recirculating system.  
A. True                      B. False

### **Air Rotary Method**

85. Air rotary methods utilize compressed water and derived rock cuttings as the drilling fluid.  
A. True                      B. False

86. Which of the following is kept in a pressured condition while drilling, in order to maintain the circulation of drilling fluid to the surface?  
A. The flighting                              C. The drilling fluid  
B. The borehole                              D. None of the above

87. Which of the following is added while drilling with air in order to maintain sufficient hole pressurization so that cuttings may be lifted to the surface efficiently while maintaining hole stability.  
A. Chemical stabilizer                      C. Biodegradable foam or surfactant (soap)  
B. Mud    D. None of the above

88. According to the text, the air rotary method is particularly suitable to soft dirt drilling with a down hole air hammer.  
A. True                      B. False

89. The air hammer makes use of compressed air to drive a piston up and down which makes \_\_\_\_\_ move up and down while the drill string rotates.  
A. The air rotary method                      C. The hammer bit  
B. A roller button bit                              D. None of the above

90. Which of the following's action produces great rock breaking force and is very valuable for drilling through solid rock or consolidated formations?  
A. The mud rotary method                      C. The combined rotating and hammering  
B. Drilling    D. None of the above

91. \_\_\_\_\_ in hard rock or consolidated formations may be used when drilling pressures are too high or borehole sizes are too large for the efficient operation of an air hammer.  
A. The air rotary method                      C. The hammer bit  
B. A roller button bit                              D. None of the above

### **Drill through Casing Driver Method**

92. The drill through casing driver method drives casing into the borehole as the telescoping kelly advances.  
A. True                      B. False

93. Which of the following is a specially designed hardened steel ring that is installed on the casing end?  
 A. Auger boring method(s)                      C. The casing driver method  
 B. The cutting shoe                                D. None of the above
94. Which of the following is inserted into the casing and the casing is attached to the casing driver?  
 A. A hammer or roller bit                      C. The rig  
 B. The drill string                                 D. None of the above
95. Which of the following penetrates into the overburden or formation, the casing driver hammers the casing down, following the drill string?  
 A. The drill string                                 C. The casing driver method  
 B. The cutting shoe                               D. None of the above
96. Which of the following may employ a hammer or roller bit?  
 A. The flighting                                    C. The drill string  
 B. The plug                                         D. None of the above
97. Cuttings rise to the surface with \_\_\_\_\_ through the casing and exit through the casing driver.  
 A. The injected air                                C. The casing driver method  
 B. The solid stem auger boring method       D. None of the above
98. According to the text as the borehole is drilled, the cuttings are then collected near?  
 A. A hammer or roller bit                      C. The rig  
 B. The drill string                                 D. None of the above
99. Which of the following can continue until competent formation is encountered?  
 A. A hammer or roller bit                      C. The addition of casing and drill string  
 B. The drill string                                 D. None of the above
100. Which of the following is often used to install temporary casing in order to permit the installation of a well in unstable aquifers?  
 A. Auger boring method(s)                      C. A rotating blade or spiral flange  
 B. The casing driver method                    D. None of the above
101. Which of the following may be used as a puller to remove the temporary casing following well construction?  
 A. The flighting                                    C. The casing driver  
 B. The plug                                         D. None of the above

**Selecting an Appropriate Well Site**

102. Before a well can be drilled a permit is normally required. The permit helps to ensure that an appropriate location of the well is selected which reduces the possibility of contamination.  
 A. True                      B. False
103. The ideal well location has good drainage and is higher than?  
 A. The quality of drinking water              C. The surrounding ground surface  
 B. The possibility of contamination         D. None of the above

104. Which of the following should be at a lower elevation than the well, and the distances to those contamination sources must be in accordance with the State or Local Water Well Construction Codes?
- A. Surface drainage(s)
  - B. Preliminary aquifer parameters
  - C. All possible sources of contamination
  - D. None of the above

## Pump and Motor Section

### Common Hydraulic Terms

105. Which of the following definitions is height of a column or body of fluid above a given point expressed in linear units?

- A. Head, Friction
- B. Head, Static
- C. Head
- D. None of the above

106. Sea level pressure is approximately 2.31 pounds per square inch absolute, 1 bar = .433psi.

- A. True
- B. False

### General Pumping Fundamentals

107. Here are the important points to consider about suction piping when the liquid being pumped is below the level of the pump: Sometimes suction lift is also referred to as 'positive suction head'.

- A. True
- B. False

### Pumps

108. Pumps are excellent examples of?

- A. Hydrostatics
- B. Quasi-static devices
- C. Multi-stage pumps
- D. None of the above

### Pump Categories

109. The key to understanding a pump's operation is that a pump is to move water and generate the \_\_\_\_\_ we call pressure.

- A. Delivery force
- B. Impeller force
- C. Diaphragm pressure
- D. None of the above

### Basic Water Pump

110. The centrifugal pumps work by spinning water around in a circle inside a?

- A. Vortex
- B. Cylinder
- C. Cylindrical pump housing
- D. None of the above

111. In the operation of the pump, the water at the edge of the \_\_\_\_\_ inward on the water between the impeller blades and makes it possible for that water to travel in a circle.

- A. Inward force
- B. Pump pushes
- C. Center of the impeller
- D. None of the above

### Types of Water Pumps

112. The water production well industry almost exclusively uses Turbine pumps, which are a type of centrifugal pump.

- A. True
- B. False

113. Which of the following are variable displacement pumps that are by far used the most?

- A. Axial flow
- B. Centrifugal pumps
- C. Turbine pumps
- D. None of the above

114. According to the text, the turbine pump utilizes impellers enclosed in single or multiple bowls or stages to?

- A. Pump head
- B. Lift water
- C. Horsepower
- D. None of the above

## Water Distribution Section

### System Elements

115. In the distribution system, storage reservoirs are structures used to store water and \_\_\_\_\_ the supply or pressure.

- A. Increase water pressure
- B. Equalize
- C. Provide a reserve pressure for
- D. None of the above

116. Booster stations are used to \_\_\_\_\_ from storage tanks for low-pressure mains.

- A. Increase water pressure
- B. Equalize
- C. Provide a reserve pressure
- D. None of the above

### Water Pressure

117. For ordinary domestic use, water pressure should be between 25 and 45 psi.

- A. True
- B. False

118. 20 psi is the minimum pressure required at any point in the water system, so that \_\_\_\_\_ is prevented.

- A. Cavitation
- B. Back pressure
- C. Backflow and infiltration
- D. None of the above

### Water Use or Demand

119. Water system demand comes from many sources including residential, commercial, industrial and public consumers as well as waste and some?

- A. Pressure
- B. System integrity
- C. Unavoidable loss
- D. None of the above

120. Which of the following is usually encountered during the summer months and can vary widely depending on irrigation practices?

- A. Maximum daily use
- B. Minimum daily use
- C. Unavoidable loss and waste
- D. None of the above

### Water Storage Introduction

121. Which of the following prevents contamination of water as it travels to the customer, finished water storage facilities are an important component of the protective distribution system?

- A. Cathodic protection
- B. Corrosion protection
- C. Barrier
- D. None of the above

### Steel Reservoirs

122. Steel reservoirs or tanks generally have higher construction and installation costs than concrete, and require less maintenance.

- A. True
- B. False

123. Steel tanks should be inspected once a year and repainted every 5-7 years.

- A. True
- B. False

(S) Means the answer can be plural or singular in nature

## Water Quality Section

### Three Types of Public Water Systems

124. Provides water to the same population year-round for example: homes, apartment buildings.

- A. TNCWS C. NTNCWSs  
B. CWSs D. None of the above

125. Approximately 85,000 systems

- A. TNCWS C. NTNCWSs  
B. CWSs D. None of the above

126. Provides water where people do not remain for long periods of time for example: gas stations, campgrounds.

- A. TNCWS C. NTNCWSs  
B. CWSs D. None of the above

### Turbidity Introduction

127. One physical feature of water is turbidity. A measure of the cloudiness of water caused by \_\_\_\_\_. The cloudy appearance of water caused by the presence of tiny particles.

- A. Suspended particles C. Temperature fluctuation  
B. Variations D. None of the above

128. High levels of turbidity may inhibit with proper water treatment and monitoring. If high quality raw water is low in turbidity, there will be a reduction in water treatment costs. Turbidity is unwanted because it causes health hazards.

- A. True B. False

### pH Testing Section

129. When an atom loses \_\_\_\_\_ and thus has more protons than electrons, the atom is a positively-charged ion or cation.

- A. A proton C. An electron  
B. Charge D. None of the above

130. Measurement of pH for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators like strip test paper.

- A. True B. False

131. In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH greater than 7 are said to be acidic and solutions with a pH less than 7 are basic or alkaline.

- A. True B. False

132. Pure water has a pH very close to?

- A. 7 C. 7.7  
B. 7.5 D. None of the above

### Objections to Hard Water Scale Formation

133. Hard water forms scale, usually \_\_\_\_\_, which causes a variety of problems. Left to dry on the surface of glassware and plumbing fixtures, including showers doors, faucets, and sink tops; hard water leaves unsightly white scale known as water spots.

- A. Magnesium carbonate C. Calcite  
B. Calcium carbonate D. None of the above

### Secondary Standard

134. TDS is most often measured in parts per million (ppm) or milligrams per liter of water (mg/L). The normal TDS level ranges from \_\_\_\_\_

- A. 50 ppm to 1,000 ppm
- B. 5 ppm to 10 ppm
- C. 50 ppm to 100 ppm
- D. None of the above

### Bacteriological Monitoring Section

**Contaminants that may be present in sources of drinking water include:**

135. Which of the following like salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming?

- A. Radioactive contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

136. Which of the following may come from a variety of sources such as agriculture, urban stormwater run-off, and residential uses?

- A. Radioactive contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

137. Which of the following, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife?

- A. Microbial contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. All of the above

138. Which of the following can be synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can come from gas stations, urban stormwater run-off, and septic systems?

- A. Organic chemical contaminants
- B. Pesticides and herbicides
- C. Inorganic contaminants
- D. Microbial contaminants

### TCR

139. The TCR recommends most of the Public Water Systems (PWS) to monitor their distribution system for bacteria according to the written sample sitting plan for that system.

- A. True
- B. False

140. The sample sitting plan identifies sampling frequency and locations throughout the distribution system that are selected to be representative of conditions in the entire system.

- A. True
- B. False

141. Coliform contamination may occur anywhere in the system, possibly due to problems such as; high pressure conditions, line fluctuations, or wells, and therefore routine monitoring is required.

- A. True
- B. False

### Routine Sampling Requirements

142. Total coliform samples must be collected by PWSs at sites which are representative of water quality throughout the distribution system according to a written sample siting plan subject to state review and revision.

- A. True
- B. False



### **Dangerous Waterborne Microbes**

143. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes cryptosporidiosis, a mild gastrointestinal disease. The disease can be severe or fatal for people with severely weakened immune systems.

- A. Coliform Bacteria
- B. Cryptosporidium
- C. Giardia lamblia
- D. None of the above

144. Which of the following are not necessarily agents of disease may indicate the presence of disease-carrying organisms?

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. Shigella dysenteriae
- D. None of the above

145. Which of the following is a parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, and cramps)?

- A. Coliform Bacteria
- B. Cryptosporidium
- C. Protozoa
- D. None of the above

146. Which of the following is a species of the rod-shaped bacterial genus Shigella?

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. Shigella dysenteriae
- D. None of the above

147. Which of the following can cause bacillary dysentery?

- A. Fecal coliform bacteria
- B. Cryptosporidium
- C. Shigella
- D. None of the above

### **The three (3) primary types of samples are:**

148. Samples collected following a coliform present routine sample. The number of repeat samples to be collected is based on the number of \_\_\_\_\_ samples you normally collect.

- A. Repeat
- B. Special
- C. Routine
- D. None of the above

149. A PWS fails to take every required repeat sample after any single TC+ sample

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

150. A PWS incurs an E. coli MCL violation.

- A. Trigger: Level 1 Assessment
- B. Trigger: Level 2 Assessment
- C. All of the above
- D. None of the above

### **Revised Total Coliform Rule (RTCR) Summary**

151. EPA published the Revised Total Coliform Rule (RTCR) in the Federal Register (FR) on February 13, 2013 (78 FR 10269). It is the revision to the 1989 Total Coliform Rule (TCR).

- A. True
- B. False

152. The RTCR upholds the purpose of the 1989 TCR to protect public health by ensuring the duplicity of the drinking water distribution system and monitoring for the absence of microbial contamination.

- A. True
- B. False

153. The RTCR establishes criteria for systems to qualify for and stay on for special increased monitoring, which could reduce water system problems for better system operation.

- A. True
- B. False

## Disinfection Section

### Chlorine's Appearance and Odor

154. Prolonged exposures to chlorine gas may result in?  
A. Moisture, steam, and water      C. Olfactory fatigue  
B. Odor thresholds                      D. None of the above

### Chlorine Gas

#### Pathophysiology

155. The odor threshold for chlorine gas is approximately?  
A. 0.3-0.5 parts per million (ppm)      C. 3-5 parts per million (ppm)  
B. 3 parts per million (ppm)              D. None of the above

### Types of Residual

156. Which of the following is all chlorine that is available for disinfection?  
A. Chlorine residual      C. Total chlorine  
B. Chlorine demand      D. None of the above

### Chlorine Exposure Limits

157. What is OSHA's PEL?  
A. 10 PPM                      C. 1,000 PPM  
B. 1 PPM                        D. None of the above

## Safety Section

### Excavation and Trenching Section

#### Competent Person

158. Competent person means one who is capable of identifying existing hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees. The \_\_\_\_\_ has authorization to take prompt corrective measures to eliminate identified hazards.  
A. Competent person                      C. Watchman  
B. Contractor                                D. None of the above

#### Competent Person Duties

159. The competent person performs daily inspections of the protective equipment, \_\_\_\_\_, safety equipment, and adjacent areas.  
A. Work progress                              C. Trench conditions  
B. Construction Crew                        D. None of the above
160. The competent person shall make \_\_\_\_\_ prior to the start of work and as needed throughout the shift.  
A. Personnel assignments                      C. Inspections  
B. Training available                            D. None of the above

#### Scope of Work

161. According to the text, during excavation work a competent person shall be on the job site at all times when personnel are working within or around the \_\_\_\_\_.  
A. Competent person                              C. Excavation  
B. Contractors                                    D. None of the above

162. The Ladder(s), stairway(s), or ramp shall be spaced so that no employee in the trench excavation is more than fifty (50') feet from a means of egress.

- A. True            B. False

163. When excavations are made in vehicular traffic areas, \_\_\_\_\_ shall wear a warning vest made with reflective material or highly visibility material.

- A. Competent persons                            C. Rescue personnel  
B. Each employee                                D. None of the above

164. The air shall be tested in excavations where \_\_\_\_\_ exist, or could be reasonably expected to exist.

- A. Limited visibilities                            C. Oxygen deficiency or gaseous conditions  
B. Employees                                      D. None of the above

165. When the atmosphere contains less than 19.5 percent oxygen, the area must be continuously ventilated until the \_\_\_\_\_.

- A. Excavation is closed                            C. Oxygen levels are above 19.5 percent  
B. Employees enter the space                    D. None of the above

166. Where a \_\_\_\_\_, the area shall be ventilated until the flammable gas concentration is below 20 percent of the LFL (lower flammable limit).

- A. Competent person requires monitoring    C. Worker encounters fumes  
B. Gaseous condition exists                    D. None of the above

167. Whenever \_\_\_\_\_ exist or could reasonably exist, the air must be monitored continuously to assure that workers are protected.

- A. Traffic conditions                              C. Oxygen deficiency or gaseous conditions  
B. Excavations                                    D. None of the above

168. Where the stability of adjoining buildings, walls or other structures are \_\_\_\_\_, shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

- A. Not a concern                                    C. Endangered by excavation operations  
B. Not mentioned in the specifications      D. None of the above

169. In situations where sidewalks, pavement and appurtenant structures may be undermined, a support system such as shoring must be provided to protect \_\_\_\_\_ from the possible collapse of such structures.

- A. Unauthorized persons                            C. Vehicles  
B. Employees                                      D. None of the above

### **Personnel Protective Systems**

170. According to the text, employees in \_\_\_\_\_ shall be protected from cave-ins by an adequate protective system, which shall be inspected by a competent person.

- A. Excavations                                    C. Protective systems  
B. Vehicles                                        D. None of the above

### Excavation Protection Systems

171. There are three basic protective systems for excavations and trenches. They are sloping and benching systems, \_\_\_\_\_, and shields.

- A. Shoring
- B. Ramps
- C. Attendants
- D. None of the above

### Sloping and Benching Systems

172. An option for sloping is to slope to the angle required by OSHA Construction Standards for Type C, which is the most \_\_\_\_\_.

- A. Unstable soil type
- B. Stable soil type
- C. Porous soil type
- D. None of the above

173. Another option for sloping is to first determine the soil type, then use the table provided in Appendix B of the standard to determine the \_\_\_\_\_.

- A. Maximum allowable angle
- B. Porosity
- C. Protective system to be used
- D. None of the above

### Shoring Systems

174. \_\_\_\_\_ is another protective system that utilizes a framework of vertical members, horizontal members, and cross braces to support the sides of the excavation to prevent a cave-in.

- A. Shoring
- B. Tabulated data
- C. Lateral support
- D. None of the above

### Shield Systems (Trench Boxes)

175. Shielding is the third method of providing a safe workplace in excavations. Unlike sloping and shoring, \_\_\_\_\_ does not prevent a cave-in.

- A. Shielding
- B. Tabulated data
- C. Soil testing
- D. None of the above

176. Shields are designed to \_\_\_\_\_, thereby protecting the employees working inside the structure.

- A. Withstand the soil forces caused by a cave-in
- B. Keep water out of the excavation
- C. Bend but not break
- D. None of the above

177. Design and construction of \_\_\_\_\_ is not covered in the OSHA Standards.

- A. Sloping and benching systems
- B. Shielding
- C. Protective systems
- D. None of the above

### Safety Precautions for Shield Systems

178. There must not be any lateral movement of \_\_\_\_\_ when installed.

- A. Sloping and benching systems
- B. Shields
- C. Ladders
- D. None of the above

### Personal Protective Equipment

179. \_\_\_\_\_ requires that employees wear a hard hat, safety glasses, and work boots on the jobsite.

- A. The contractor
- B. OSHA policy
- C. Recommended practice
- D. None of the above

### Excavation & Trenching Guidelines

180. Procedures and guidelines for the protection of employees working in and around excavations and trenches must be in compliance with OSHA Standards described in Subpart P (CFR 1926.650) for the construction industry.

- A. True      B. False

181. According to the text, the competent person(s) must be trained in accordance with the OSHA Excavation Standard, and all other programs that may apply, and must demonstrate a thorough understanding and knowledge of the programs and the hazards associated.

- A. True      B. False

182. All other employees working in and around the excavation must be trained to recognize the hazards associated with \_\_\_\_\_.

- A. OSHA Standards      C. Personal protective equipment  
B. Trenching and excavating      D. None of the above

### Hazard Controls

183. Knowing the location of underground installations is a good idea because it could make the work go faster.

- A. True      B. False

184. All overhead hazards (surface encumbrances) must be removed or supported to \_\_\_\_\_.

- A. Meet OSHA Standards      C. Eliminate the hazard  
B. Make trenching and excavating easier      D. None of the above

185. If \_\_\_\_\_ will be over 20 feet deep, it must be designed by a registered professional engineer.

- A. An excavation      C. Construction equipment  
B. A means of access or egress      D. None of the above

186. \_\_\_\_\_, such as sloping, shoring, or shielding, will be utilized to protect employees.

- A. Adequate protective systems      C. Soil testing  
B. Soil classifications      D. None of the above

187. An excavation safety plan must be developed to protect employees.

- A. True      B. False

188. Workers must be supplied with, and wear, any \_\_\_\_\_ deemed necessary to protect them while working in excavations.

- A. Uniforms      C. Personal protective equipment  
B. Apparel      D. None of the above

### Excavation Safety Plan

189. A written excavation safety plan is required. This plan is to be developed to the level necessary to ensure complete compliance with the \_\_\_\_\_ and state and local safety standards.

- A. Professional engineer's requirements      C. Protective systems  
B. OSHA Excavation Safety Standard      D. None of the above

### Soil Classification and Identification

190. The Simplified Soil Classification System defined by OSHA Standards consists of four categories: \_\_\_\_\_, Type A, Type B, and Type C.

- A. Stable rock
- B. Gravel
- C. Stiff clay
- D. None of the above

### Soil Test & Identification

191. The competent person will classify the \_\_\_\_\_ according to the definitions in Appendix A of the OSHA standard based on at least one visual and one manual analysis.

- A. Shields
- B. Soil type
- C. Cohesion tests
- D. None of the above

192. According to the text, the competent person must also determine the level of protection based on what conditions exist at the time of the test, and \_\_\_\_\_.

- A. Available equipment
- B. Tabulated data
- C. Allow for changing conditions
- D. None of the above

### Shielding

193. Shielding does not prevent cave-ins. Instead, it protects the workers in the event of a cave-in.

- A. True
- B. False

194. An operation where a contractor excavates just enough trench to install the shield, then sets a joint of pipe, then excavates further, then pulls the shield forward to install another joint while the first is being backfilled, is known as "\_\_\_\_\_".

- A. Shielding
- B. Cut and cover
- C. Standard practice
- D. None of the above

195. Workers must exit the shield during its installation, removal, or \_\_\_\_\_.

- A. Inclement weather
- B. Soil testing
- C. During vertical movement
- D. None of the above

196. The excavation wall at the \_\_\_\_\_ should be sloped, shored or shielded off to prevent a cave-in from the end.

- A. Side of the shield
- B. End of the job
- C. Open end of the shield
- D. None of the above

197. If the excavation will be deeper than the \_\_\_\_\_, attached shields of the correct specifications may be used. As an alternate, the excavation may be sloped back to the maximum allowable angle from a point 18 inches below the top of the shield.

- A. Planned depth
- B. Shield is tall
- C. Designed depth
- D. None of the above

### Inspections

198. The excavations, adjacent areas, and protective systems shall be inspected daily by the \_\_\_\_\_.

- A. Contractor
- B. Employees
- C. Competent person
- D. None of the above

199. During inspections, the competent person shall look for evidence of a situation that could result in a cave-in, indications of \_\_\_\_\_, hazardous atmospheres or other hazardous conditions.

- A. Failure of protective systems
- B. Poor workmanship
- C. OSHA compliance
- D. None of the above

200. All \_\_\_\_\_ shall be conducted by the competent person prior to the start of work, as needed throughout the shift, and after every rainstorm or other increasing hazard.

- A. Inspections
- B. Writing of excavation reports
- C. OSHA compliance inspections
- D. None of the above