

**Registration form**

**Groundwater Protection CEU Training Course \$100.00  
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

Start and Finish Dates \_\_\_\_\_  
*You will have 90 days from this date in order to complete this course*

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*

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

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

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Home (\_\_\_\_\_) \_\_\_\_\_ Work (\_\_\_\_\_) \_\_\_\_\_

Operator ID# \_\_\_\_\_ Exp Date \_\_\_\_\_

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

Water Treatment \_\_\_ Water Distribution \_\_\_ Onsite \_\_\_

Wastewater Treatment \_\_\_ UST Owner \_\_\_ Other \_\_\_\_\_

*Your certificate will be emailed to you in about two weeks.*

**Technical Learning College PO Box 3060, Chino Valley, AZ 86323**  
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## **DISCLAIMER NOTICE**

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I fully understand that this type of study program deals with dangerous, changing conditions and various laws and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable in any fashion for any errors, omissions, advice, suggestions or neglect contained in this CEU education training course or for any violation or injury, death, neglect, damage or loss of your license or certification caused in any fashion by this CEU education training or course material suggestion or error or my lack of submitting paperwork. It is my responsibility to call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded. It is my responsibility to ensure all information is correct and to abide with all rules and regulations.

*You can obtain a printed version of the course from TLC for an additional \$59.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

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

**Some States and many employers require the final exam to be proctored.**

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

**All downloads are electronically tracked and monitored for security purposes.**

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

## 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:

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Date of Birth:

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Email Address:

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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



# For Texas TCEQ Wastewater Licensed Operators

## 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 sign and date this notice

Printed Name

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Signature

Date

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# Groundwater Protection CEU Course Answer Key

Name \_\_\_\_\_ Telephone # \_\_\_\_\_

You are solely responsible to ensure that your State will accept this course for credit. No refunds. Did you check with your State agency 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 are responsible to ensure that TLC receives the Assignment and Registration Key. Please call us to ensure that we received it.*

You can also fill this assignment out electronically in Adobe Acrobat DC

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

- |                 |                 |                 |
|-----------------|-----------------|-----------------|
| 1. A B C D E F  | 17. A B C D E F | 33. A B C D E F |
| 2. A B C D E F  | 18. A B C D E F | 34. A B C D E F |
| 3. A B C D E F  | 19. A B C D E F | 35. A B C D E F |
| 4. A B C D E F  | 20. A B C D E F | 36. A B C D E F |
| 5. A B C D E F  | 21. A B C D E F | 37. A B C D E F |
| 6. A B C D E F  | 22. A B C D E F | 38. A B C D E F |
| 7. A B C D E F  | 23. A B C D E F | 39. A B C D E F |
| 8. A B C D E F  | 24. A B C D E F | 40. A B C D E F |
| 9. A B C D E F  | 25. A B C D E F | 41. A B C D E F |
| 10. A B C D E F | 26. A B C D E F | 42. A B C D E F |
| 11. A B C D E F | 27. A B C D E F | 43. A B C D E F |
| 12. A B C D E F | 28. A B C D E F | 44. A B C D E F |
| 13. A B C D E F | 29. A B C D E F | 45. A B C D E F |
| 14. A B C D E F | 30. A B C D E F | 46. A B C D E F |
| 15. A B C D E F | 31. A B C D E F | 47. A B C D E F |
| 16. A B C D E F | 32. A B C D E F | 48. A B C D E F |

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|-----------------|-----------------|------------------|
| 49. A B C D E F | 68. A B C D E F | 87. A B C D E F  |
| 50. A B C D E F | 69. A B C D E F | 88. A B C D E F  |
| 51. A B C D E F | 70. A B C D E F | 89. A B C D E F  |
| 52. A B C D E F | 71. A B C D E F | 90. A B C D E F  |
| 53. A B C D E F | 72. A B C D E F | 91. A B C D E F  |
| 54. A B C D E F | 73. A B C D E F | 92. A B C D E F  |
| 55. A B C D E F | 74. A B C D E F | 93. A B C D E F  |
| 56. A B C D E F | 75. A B C D E F | 94. A B C D E F  |
| 57. A B C D E F | 76. A B C D E F | 95. A B C D E F  |
| 58. A B C D E F | 77. A B C D E F | 96. A B C D E F  |
| 59. A B C D E F | 78. A B C D E F | 97. A B C D E F  |
| 60. A B C D E F | 79. A B C D E F | 98. A B C D E F  |
| 61. A B C D E F | 80. A B C D E F | 99. A B C D E F  |
| 62. A B C D E F | 81. A B C D E F | 100. A B C D E F |
| 63. A B C D E F | 82. A B C D E F |                  |
| 64. A B C D E F | 83. A B C D E F |                  |
| 65. A B C D E F | 84. A B C D E F |                  |
| 66. A B C D E F | 85. A B C D E F |                  |
| 67. A B C D E F | 86. A B C D E F |                  |

**Additional certificate for another Agency – additional fee \$50**

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

**Rush Grading Service**

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



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

**GROUNDWATER PROTECTION CEU TRAINING 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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How about the price of the course? Poor \_\_ Fair\_\_ Average\_\_ Good \_\_ Great

How was your customer service? Poor \_\_ Fair\_\_ Average\_\_ Good \_\_ Great \_\_

Any other concerns or comments.

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## Groundwater Protection CEU Course Assignment

*The Assignment (Exam) is also 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 the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to [info@tlch2o.com](mailto:info@tlch2o.com).

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your Answer Key and make copy for yourself. You can e-mail or fax your Answer Key along with the Registration Form to TLC. **(S) Means answer may be plural or singular. Multiple Choice Section. One answer per question and please use the answer key.**

1. Which of the following terms is controlled largely by its porosity, or the relative amount of open space present to hold water?  
A. Water table  
B. Groundwater  
C. An aquifer's storage capacity  
D. Cone of depression  
E. Well  
F. None of the Above
2. There are two kinds of aquifers: confined and unconfined.  
A. True  
B. False
3. If the aquifer is sandwiched between layers of relatively impermeable materials, it is called?  
A. Confined aquifer  
B. Aquifer(s)  
C. Hydrologic cycle  
D. Water table  
E. Unconfined aquifer  
F. None of the Above
4. Confined aquifers are not sandwiched between layers of relatively impermeable materials, and their upper boundaries are generally closer to the surface of the land.  
A. True  
B. False
5. Which of the following terms are frequently found at greater depths than unconfined aquifers?  
A. Confined aquifer(s)  
B. Aquifer(s)  
C. Hydrologic cycle  
D. Water table  
E. Unconfined aquifer  
F. None of the Above

### **Does Ground Water Move?**

6. Ground water can move sideways as well as up or down. This movement is in response to gravity, differences in elevation, and?  
A. Synthetic organic chemical(s)  
B. Differences in pressure  
C. Permeable zones  
D. Ground-water contamination  
E. Septic tanks, cesspools, and privies  
F. None of the Above

7. Ground water can move even more rapidly in karst aquifers, which are areas in which missing term 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. Contaminant(s)                      D. Water soluble limestone  
 B. Saturated zone                      E. Serious contamination source(s)  
 C. Karst aquifer(s)                      F. None of the Above

**Ground-Water Quality**

8. 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
9. We know that some contaminants can pass through all of these filtering layers into this missing term to contaminate ground water.
- A. Contaminant(s)                      D. Saturated zone  
 B. Saturated zone                      E. Water table  
 C. Karst aquifer(s)                      F. None of the Above

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

10. Substances that can contaminate \_\_\_\_\_ 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)      D. Ground-water contamination  
 B. Ground water                      E. Septic tanks, cesspools, and privies  
 C. Permeable zones                      F. None of the Above
11. A significant number of today's groundwater contamination problems stem from man's activities and can be introduced into ground water from?
- A. Contaminant(s)                      D. Iron, calcium, and selenium  
 B. Saturated zone                      E. Serious contamination source(s)  
 C. A variety of sources                      F. None of the Above

**Agricultural Activities**

12. Agricultural activities also can make significant contributions to \_\_\_\_\_ contamination with the millions of tons of fertilizers and pesticides spread on the ground and from the storage and disposal of livestock wastes.
- A. Synthetic organic chemical(s)      D. Ground-water  
 B. Ground water                      E. Septic tanks, cesspools, and privies  
 C. Permeable zones                      F. None of the Above

**Landfills**

13. A number of these sites have caused which missing term and are now being cleaned up by their owners, operators, or users; state governments; or the federal government under the Superfund program?
- A. Synthetic organic chemical(s)      D. Serious ground-water contamination problems  
 B. Ground water                      E. Septic tanks, cesspools, and privies  
 C. Permeable zones                      F. None of the Above

### **Abandoned Wells**

14. Which of the following terms can be another source of ground-water contamination?

- A. Contaminant(s)
- B. Saturated zone
- C. Karst aquifer(s)
- D. Wells
- E. Serious contamination source(s)
- F. None of the Above

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

- A. Synthetic organic chemical(s)
- B. Ground water
- C. A well
- D. Ground-water contamination
- E. Septic tanks, cesspools, and privies
- F. None of the Above

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

16. In general, a community whose ground-water supply has been contaminated has five options: Contain the contaminants to prevent their migration from?

- A. Aquifer
- B. Contamination
- C. Toxic chemicals
- D. Supplies of clean ground water
- E. Their source
- F. None of the Above

17. According to the text, withdraw the pollutants from the?

- A. Aquifers
- B. Contamination
- C. Toxic chemicals
- D. Supplies of ground water
- E. Wellhead protection program(s)
- F. None of the Above

18. According to the text, treat the missing term where it is withdrawn or at its point of use.

- A. Aquifer
- B. Contamination
- C. Toxic chemicals
- D. Ground water
- E. Wellhead protection program(s)
- F. None of the Above

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

- A. Aquifer
- B. Contamination
- C. Toxic chemicals
- D. Supplies of clean ground water
- E. Wellhead protection program(s)
- F. None of the Above

### **Are There Federal Laws or Programs to Protect Ground Water?**

20. The U.S. Environmental Protection Agency is responsible for federal activities relating to the quality of ground water.

- A. True
- B. False

21. Which of the following terms authorizes EPA to set standards for maximum levels of contaminants in drinking water, regulate the underground disposal of wastes in deep wells, and designate areas that rely on a single aquifer for their water supply?

- A. The Clean Water Act
- B. EPA's groundwater
- C. Alternative sources of water
- D. The Safe Drinking Water Act
- E. The Resource Conservation and Recovery Act
- F. None of the Above

22. Which of the following terms regulates the storage, transportation, treatment, and disposal of solid and hazardous wastes?

- A. The Clean Water Act
- B. EPA's groundwater
- C. Alternative sources of water
- D. The Safe Drinking Water Act
- E. The Resource Conservation and Recovery Act
- F. None of the Above

23. According to the text, the Comprehensive Environmental Response, Compensation, and Liability Act authorizes the government to clean up contamination caused by chemical spills or hazardous waste sites that could pose threats to the environment, and whose 1986 amendments include provisions authorizing citizens to sue violators of the law and establishing?

- A. The Clean Water Act
- B. EPA's groundwater
- C. Alternative sources of water
- D. The Safe Drinking Water Act
- E. Community right-to-know
- F. None of the Above

24. The Federal Insecticide, Fungicide, and Rodenticide Act, which authorizes which term to control the availability of pesticides that have the ability to leach into ground water?

- A. The Clean Water Act
- B. EPA
- C. Alternative sources of water
- D. The Safe Drinking Water Act
- E. The Resource Conservation and Recovery Act
- F. None of the Above

25. Which of the following terms which authorizes EPA to control the manufacture, use, storage, distribution, or disposal of toxic chemicals that have the potential to leach into ground water?

- A. The Clean Water Act
- B. The Toxic Substances Control Act
- C. Alternative sources of water
- D. The Safe Drinking Water Act
- E. Resource Conservation Act
- F. None of the Above

26. Which of the following terms authorizes EPA to make grants to the states for the development of ground-water protection strategies and authorizes a number of programs to prevent water pollution from a variety of potential sources?

- A. The Clean Water Act
- B. EPA's groundwater
- C. Alternative sources of water
- D. The Safe Drinking Water Act
- E. The Resource Conservation and Recovery Act
- F. None of the Above

### **Water Well Reports and Hydrogeology**

#### **Hydrogeologic Data**

27. 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

#### **Depth to the Aquifer**

28. It is important to know the type of geologic materials that occur from the surface down to the top of the?

- A. Aquifer
- B. Hydraulic head
- C. Geologic materials
- D. Amount of recharge to the aquifer
- E. Ground water
- F. None of the Above

### Nature of the Aquifer

29. An unconfined aquifer has which missing term 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. A confined aquifer
- D. Hydraulic conductivity
- E. Permeability or hydraulic conductivity
- F. None of the Above

30. 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. Aquifer (porosity)
- B. Hydraulic head
- C. Geologic materials
- D. Water table
- E. Ground water
- F. None of the Above

31. Which of the following terms has a low-permeability geologic formation as its upper boundary?

- A. Hydraulic head
- B. An aquifer
- C. A confined aquifer
- D. Hydraulic conductivity
- E. Permeability or hydraulic conductivity
- F. None of the Above

### Hydraulic Head (h)

32. According to the text, 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

33. Which of the following terms has units of feet, and generally corresponds to the elevation of water in the well?

- A. Aquifer (porosity)
- B. Hydraulic head
- C. Geologic materials
- D. Amount of recharge to the aquifer
- E. Ground water
- F. None of the Above

34. Hydraulic head is the driving force for ground water movement either in a horizontal or vertical direction.

- A. True
- B. False

35. Which of the following terms moves from where the head is higher to where the head is lower?

- A. Hydraulic head
- B. An aquifer
- C. Ground water
- D. Hydraulic conductivity
- E. Permeability or hydraulic conductivity
- F. None of the Above

### Aquifer Porosity (n)

36. The volume of open space relative to the \_\_\_\_\_ and the degree to which these pore spaces are interconnected controls the volume of water in the aquifer and the amount of water that can be reasonably withdrawn from the aquifer.

- A. Total volume of the aquifer (porosity)
- B. Hydraulic head
- C. Geologic materials
- D. Amount of recharge to the aquifer
- E. Ground water
- F. None of the Above

### **Permeability of the Aquifer (K)**

37. Which of the following terms or the permeability of the aquifer is a measure of how fast ground water can move through the aquifer?

- A. Hydraulic head
- B. An aquifer
- C. A confined aquifer
- D. Conductivity
- E. Hydraulic conductivity
- F. None of the Above

38. Which of the following terms has units of distance/time, e.g., feet/day, although it does not represent an actual speed?

- A. Hydraulic head
- B. An aquifer
- C. A confined aquifer
- D. Hydraulic conductivity
- E. Permeability
- F. None of the Above

### **In What Direction Is Groundwater Flowing?**

39. If several wells produce from the same aquifer, we can estimate the direction of ground water flow.

- A. True
- B. False

40. The direction of ground water flow is from higher to lower?

- A. Aquifer (porosity)
- B. Hydraulic head
- C. Geologic materials
- D. Amount of recharge to the aquifer
- E. Ground water
- F. None of the Above

41. Which of the following terms 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. An aquifer
- C. A confined aquifer
- D. Hydraulic conductivity
- E. Permeability, or hydraulic conductivity
- F. None of the Above

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

42. There is a relation between the pumping rate of the well, the transmissivity of the aquifer, the distance between wells, this missing term, and the duration of the pumping event.

- A. Aquifer (porosity)
- B. Hydraulic head
- C. Geologic materials
- D. Amount of recharge to the aquifer
- E. Storage coefficient of the aquifer
- F. None of the Above

### **Depth to First Water-Bearing Zone**

43. Some report the depth at which water is first encountered in?

- A. The drill hole
- B. SWL
- C. The yield
- D. Recharge and discharge zone(s)
- E. Hydrogeologic investigation(s)
- F. None of the Above

### **Static Water Level**

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

- A. Static water level (SWL)
- B. Data on the well report
- C. Local ground water systems
- D. Perforated portions of cased wells
- E. Weak (fractured) zones
- F. None of the Above



45. 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

46. A progressive change in the perforated portions of cased wells can indicate to the hydrogeologist that the area represents a recharge zone or a discharge zone.

- A. True            B. False

47. Which of the following terms have important implications in ground water protection and identifying the relation between area ground water and local streams?

- A. Weak (fractured) zones    D. Recharge and discharge zone(s)  
B. SWL                            E. Hydrogeologic investigation(s)  
C. The yield                      F. None of the Above

### **Water-Bearing Zones**

48. 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. A. True            B. False

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

- A. Water-bearing zone(s)    D. Recharge and discharge zone(s)  
B. SWL                            E. Hydrogeologic investigation(s)  
C. Yield                            F. None of the Above

### **Lithologic Log**

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

- A. True            B. False

51. Clear descriptions of the material drilled through the relative proportions of silt/clay in the sand units, the locations of weak zones in bedrock, whether a clay unit contains lenses or layers of sand, etc., allow the hydrogeologist to better estimate the potential permeability of?

- A. Static water level                      D. Perforated portions of cased wells  
B. These zones                            E. Weak (fractured) zones  
C. Local ground water systems        F. None of the Above

### **Contributions of Well Constructors to Hydrogeology**

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

- A. Static water level                      D. Perforated portions of cased wells  
B. Well report                              E. Weak (fractured) zones  
C. Local ground water systems        F. None of the Above

### How Wells Are Drilled

53. A few examples of today's more common well drilling methods include rotary, auger, and cable tool with?

- A. Many variations of each
- B. Typical drilling fluid(s)
- C. Advanced methods
- D. A highly trained and skilled driller
- E. Today's more common well drilling methods
- F. None of the Above

54. Drilling fluids are often used during drilling in order to keep the borehole open while drilling is done.

- A. True
- B. False

55. Which of the following terms stabilize the hole and aid in the removal of cuttings?

- A. The flighting
- B. Drilling fluids
- C. The bucket
- D. A telescoping kelly
- E. The cutting head
- F. None of the Above

56. Typical drilling fluids may be water, mud, air, chemical or natural additives, or combinations of each.

- A. True
- B. False

57. Air rotary with \_\_\_\_\_ is particularly suited for hard rock drilling, while mud rotary is better suited for drilling in sediment.

- A. Downhole hammer
- B. The Kelly
- C. The table drive
- D. A sub
- E. Rotary bit
- F. None of the Above

### Pump Selection

#### Three Basic Types of Wells

58. Which of the following terms are usually bored into an unconfined water source, generally found at depths of 100 feet or less?

- A. Unconsolidated or sand well(s)
- B. Bored or shallow well(s)
- C. The proper selection
- D. Total dynamic or discharge head
- E. The most important components
- F. None of the Above

59. Which of the following terms are drilled into a formation consisting entirely of a natural rock formation that contains no soil and does not collapse?

- A. Consolidated or rock wells
- B. Screen filter(s)
- C. Power requirement(s)
- D. Total equivalent feet of lift
- E. The total friction head
- F. None of the Above

60. Which of the following terms are drilled into a formation consisting of soil, sand, gravel, or clay material that collapses upon itself?

- A. Unconsolidated or sand well(s)
- B. Bored or shallow well(s)
- C. The proper selection
- D. Total dynamic or discharge head
- E. The most important components
- F. None of the Above

### Selection of Pumping Equipment

61. The proper selection of pumping equipment for a well is of great importance.

- A. True
- B. False

### **Pumping Lift and Total Dynamic or Discharge Head**

62. The most important components in selecting the correct pump for your application are: total pumping lift and?

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Total dynamic or discharge head
- E. Pressure head
- F. None of the Above

63. Which of the following terms refers to the total equivalent feet of lift that the pump must overcome in order to deliver water to its destination, including frictional losses in the delivery system?

- A. Total dynamic head
- B. Screen filter(s)
- C. Power requirement(s)
- D. Total equivalent feet of lift
- E. The total friction head
- F. None of the Above

### **Basic Pump Operating Characteristics**

64. Pressure and head are interchangeable concepts in irrigation, because a column of water .433 feet high is equivalent to 2.31 pound per square inch of pressure.

- A. True
- B. False

65. Which of the following terms of a pump is composed of several types of head that help define the pump's operating characteristics?

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Total head
- E. Pressure head
- F. None of the Above

### **Total Dynamic Head**

66. The total dynamic head of a pump is the sum of \_\_\_\_\_, the pressure head, the friction head, and the velocity head.

- A. The total static head
- B. Screen filter(s)
- C. Power requirement(s)
- D. Total equivalent feet of lift
- E. The total friction head
- F. None of the Above

67. The Total Dynamic Head is the sum of the total static head, the \_\_\_\_\_ and the pressure head.

- A. Cavitation
- B. Suction head
- C. Velocity head
- D. Loss of head
- E. Total friction head
- F. None of the Above

### **Total Static Head**

68. The total static head is the total vertical distance the pump must lift the water.

- A. True
- B. False

69. When pumping from a well, it would be the distance from the pumping water level in the well to the ground surface plus \_\_\_\_\_ the water is lifted from the ground surface to the discharge point.

- A. Friction head
- B. Total static head
- C. Vertical distance
- D. Total dynamic or discharge head
- E. Loss of head
- F. None of the Above

**Pressure Head**

70. 20 PSI is equal to 20 times 2.31 or 46.2 feet of head.

- A. True      B. False

**Friction Head**

71. The velocity of the water has a significant effect on?

- A. Friction head                      D. Total dynamic or discharge head  
B. Friction loss                        E. Loss of head  
C. Pressure head                        F. None of the Above

72. Values for these losses can be calculated or obtained from friction loss tables. The friction head for a piping system is the sum of all the?

- A. Friction head                        D. Total dynamic or discharge head  
B. Friction losses                       E. Loss of head  
C. Pressure head                        F. None of the Above

**Velocity Head**

73. Velocity head is the energy of the water due to?

- A. Cavitation                          D. Loss of head  
B. Suction head                        E. Its velocity  
C. Velocity head                        F. None of the Above

**Suction Head**

74. According to the text, the suction head includes not only the vertical suction lift, but also the friction losses through the pipe, elbows, foot valves, and other fittings on the suction side of the pump.

- A. True      B. False

75. There is an allowable limit to \_\_\_\_\_ on a pump and the net positive suction head of a pump sets that limit.

- A. Cavitation                          D. Loss of head  
B. Suction head                        E. Pressure head  
C. Velocity head                        F. None of the Above

76. The theoretical maximum height that water can be lifted using suction is 21 feet.

- A. True      B. False

77. The NPSH curve will increase with increasing flow rate through the pump.

- A. True      B. False

78. At a certain flow rate, the NPSH is subtracted from 23 feet to determine the maximum suction head at which that pump will operate.

- A. True      B. False

79. Operating a pump with \_\_\_\_\_ than it was designed for, or under conditions with excessive vacuum at some point in the impeller, may cause cavitation.

- A. Suction lift greater                      D. Loss of head  
B. Suction head                              E. Pressure head  
C. Velocity head                              F. None of the Above

80. Which of the following terms is the implosion of bubbles of air and water vapor and makes a very distinct noise like gravel in the pump?

- A. Friction head
- B. Total static head
- C. Pressure head
- D. Cavitation
- E. Loss of head
- F. None of the Above

81. Which of the following terms must also protect water quality between the source and the customer's tap?

- A. Distribution system
- B. Water pressure
- C. Fire protection
- D. Hydropneumatic tanks and surge tanks
- E. Cavitation
- F. None of the Above

82. Care must be taken that no foreign material is introduced into the system during pipe laying operations. Pipe ends should be covered at the end of the workday or during interruptions of construction.

- A. True
- B. False

### **Water Use or Demand**

83. Water system demand comes from a number of sources including residential, commercial, industrial and public consumers as well as waste and some?

- A. Pressure
- B. System integrity
- C. Unavoidable loss
- D. Unavoidable loss and waste
- E. Maximum daily use
- F. None of the Above

84. The combination of storage reservoirs and distribution lines must be capable of meeting consumers' needs for pressure at all times.

- A. True
- B. False

85. The quantity of water used in any community varies from 100 to 200 gallons per person per day.

- A. True
- B. False

86. Which of the following terms is desired, that could also represent a rather significant demand upon the system?

- A. Distribution system
- B. Water pressure
- C. Fire protection
- D. Hydropneumatic tanks and surge tanks
- E. Cavitation
- F. None of the Above

87. A common design assumption is to use from 100 to 150 gallons per person per day for average domestic use.

- A. True
- B. False

88. The maximum daily use is approximately 3 to 5 times the average daily use.

- A. True
- B. False

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

- A. Pressure
- B. System integrity
- C. Maximum daily use
- D. Unavoidable loss and waste
- E. Minimum daily use
- F. None of the Above

### **Water Pressure**

90. 2.31 feet of water is equal to 1 psi, or 1 foot of water is equal to about a half a pound (.433 pounds to be exact).

- A. True      B. False

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

- A. True      B. False

92. 20 psi is considered the minimum required at any point in the water system, so that which missing term is prevented?

- A. Distribution system      D. Hydropneumatic tanks and surge tanks  
B. Water pressure      E. Cavitation  
C. Backflow and infiltration      F. None of the Above

93. Which of the following terms is provided by the direct force of the water, or by the height of the water?

- A. Pressure      D. Unavoidable loss and waste  
B. System integrity      E. Maximum daily use  
C. Gravity      F. None of the Above

### **Storage and Distribution**

#### **Water Storage Facilities**

94. According to the text, there are different types that are used in the water distribution systems, such as stand pipes, elevated tanks and reservoirs, hydropneumatic tanks and?

- A. Distribution system      D. Surge tanks  
B. Water pressure      E. Cavitation  
C. Fire protection      F. None of the Above

#### **Storage Reservoirs**

95. According to the text, it is also recommended that storage reservoirs be located at a high enough elevation to allow the water to flow by which term to the distribution system?

- A. Pressure      D. Cross-connection  
B. System integrity      E. Maximum daily use  
C. Gravity      F. None of the Above

96. According to the text, some storage for which term should be provided?

- A. Fire protection      D. Cross-connection  
B. Reservoir(s)      E. Stored water  
C. Steel tank(s)      F. None of the Above

97. Which of the following terms are also used as detention basins to provide the required chlorine contact time necessary to ensure the adequacy of disinfection?

- A. Baffle(s)      D. Cross-connection  
B. Reservoir(s)      E. Stored water  
C. Steel tank(s)      F. None of the Above

**Water Storage Introduction**

98. According to the text, treated or pumped water is placed in \_\_\_\_\_ in order for disinfection to take place.

- A. Storage reservoirs
- B. Water distribution systems
- C. Steel reservoirs
- D. A closed tank or reservoir
- E. Repairing and replacing these facilities
- F. None of the Above

**Storage and Distribution**

99. The cost of supplying water to the users of any water system includes are on-going maintenance costs associated with cleaning, repairing and replacing these?

- A. Storage reservoirs
- B. Facilities
- C. Steel reservoirs
- D. Adequate pressure
- E. Clearwells
- F. None of the Above

100. Water storage facilities and tanks vary in different types that are used in the water distribution systems, such as stand pipes, elevated tanks and reservoirs, hydropneumatic tanks and?

- A. Storage reservoirs
- B. Water distribution systems
- C. Steel reservoirs
- D. Adequate pressure
- E. Surge tanks
- F. None of the Above