

**Registration Form**

**Distribution Operations CEU Training Course \$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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**Class/Grade** \_\_\_\_\_

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

Water Treatment \_\_\_\_\_ Distribution \_\_\_\_\_ Groundwater \_\_\_\_\_

Well Drillers \_\_\_\_\_ Pump Installer \_\_\_\_\_ Other \_\_\_\_\_

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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.

**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. Do not solely trust our list for it may be outdated. It is your sole responsibility to ensure this course is accepted for credit.

**Professional Engineers**; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

*You can obtain a printed version of the course manual from TLC for an additional \$69.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

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

## **Grading Information**

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

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

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

**Do not solely depend on TLC's Approval list for it may be outdated.**

**A second certificate of completion for a second State Agency \$50 processing fee.**

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# Distribution Operations Answer Key

Name \_\_\_\_\_

Phone \_\_\_\_\_

**You are solely responsible in ensuring that this course is accepted for credit by your State. 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***

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**What is the approval number if Applicable? \_\_\_\_\_**

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***You can use Adobe Acrobat DC Program to complete the assignment.***

Please Circle, Bold, Underline or X, one answer per question.

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***You are responsible to ensure that TLC receives the Assignment and Registration Key. Please call us to ensure that we received it.***

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

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

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

Thank you...

**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.

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

**DISTRIBUTION OPERATIONS  
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Very Easy 0 1 2 3 4 5 Very Difficult

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

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Any other concerns or comments.

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

## DISTRIBUTION OPERATIONS CEU TRAINING COURSE ASSIGNMENT

*The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit [www.ABCTLTC.com](http://www.ABCTLTC.com) and download the assignment and e- mail it back to TLC.*

You will have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. 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.**

### Backflow/Cross-Connection Section

#### What is backflow? Reverse flow condition

- Which of the following terms is there two forms-backpressure and backsiphonage?  
A. Backflow                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above
- The basic mechanism for preventing backflow is a mechanical \_\_\_\_\_, which provides a physical barrier to backflow.  
A. High hazard installations                      D. Backflow  
B. Air gap    E. Device or method  
C. Backflow preventer                              F. None of the Above
- The principal types of mechanical backflow preventers are the reduced-pressure principle assembly, the \_\_\_\_\_, and the double check valve assembly.  
A. High hazard installations                      D. Backflow  
B. Air gap    E. Device or method  
C. Vacuum breaker                                F. None of the Above
- Backflow is the undesirable reversal of flow of non-potable water or other substances through a \_\_\_\_\_ and into the piping of a public water system or consumer's potable water system.  
A. Backflow                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above
- Which of the following terms can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both?  
A. Backflow                      D. Cross-connection  
B. Backpressure                E. Indirect connection  
C. Backsiphonage              F. None of the Above

6. Which of the following terms can occur when there is a stoppage of water supply due to nearby firefighting, a break in a water main?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

7. Which of the following terms is any temporary or permanent connection between a public water system or consumer's potable water system and any source or system containing non-potable water or other substances?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

8. Which of the following terms is a form of backflow caused by a negative pressure (i.e., a vacuum or partial vacuum) in a public water system or consumer's potable water system?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

#### **Types of Backflow Prevention Methods and Assemblies**

9. Which of the following terms must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?

- A. Backflow
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. Indirect connection
- F. None of the Above

10. The type of device selected for a particular installation depends on several factors.

- A. True
- B. False

11. When the airflow is restricted, such as the case of an air gap located near a wall, the \_\_\_\_\_ separation must be increased.

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

12. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of an?

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

13. Which of the following terms must be at least two times the diameter of the supply pipe and not less than one inch?

- A. Open receiving vessel
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

14. According to the text, an air break is a physical separation between the free flowing discharge end of a potable water supply pipeline, and the overflow rim of an open or non-pressure receiving vessel.  
 A. True      B. False
15. An air gap is acceptable for \_\_\_\_\_ and is theoretically the most effective protection.  
 A. High hazard installations    D. Low pollutional hazards  
 B. Backflow preventer          E. High pollutional concerns  
 C. Barrier to backflow          F. None of the Above

**Water Distribution Section - Water Distribution System Design and Valves -System Elements**

16. Valves control the flow of water in the distribution system by isolating areas for repair or by?  
 A. Increase water pressure      D. Main line isolation  
 B. Bypasses                        E. Regulating system flow or pressure.  
 C. Complete gridiron system    F. None of the Above
17. According to the text, Gate valves should be used in the \_\_\_\_\_ for main line isolation.  
 A. Increase water pressure      D. Distribution system  
 B. Distribution tree                E. Arterial system  
 C. Complete gridiron system    F. None of the Above
18. Distribution mains function is to carry water from the water source or treatment works to users, these are the pipelines that make up the?  
 A. Increase water pressure      D. Distribution system  
 B. Distribution tree                E. Arterial system  
 C. Complete gridiron system    F. None of the Above
19. Arterial mains are interconnected with smaller distribution mains to form a complete gridiron system and are for?  
 A. Increasing water pressure    D. Distribution mains of large size  
 B. Tree system                      E. Fire protection  
 C. Complete gridiron system    F. None of the Above
20. Storage reservoirs are structures used to store water and \_\_\_\_\_ the supply or pressure in the distribution system.  
 A. Increase water pressure      D. Main line isolation  
 B. Equalize                          E. Provide a reserve pressure  
 C. Complete gridiron system    F. None of the Above
21. Booster stations are used to \_\_\_\_\_ from storage tanks for low-pressure mains.  
 A. Increase water pressure      D. Boost flow  
 B. Equalize                          E. Provide a reserve pressure  
 C. Complete gridiron system    F. None of the Above
22. Valve exercising should be done to locate inoperable due to freezing or build-up of rust or corrosion and done once per year to detect \_\_\_\_\_ and to prevent valves from becoming  
 A. Malfunctioning valves      D. Minimum flow restriction  
 B. Dependability                E. Stops or allows  
 C. Repair or replacement      F. None of the Above

23. A valve inspection should include drawing valve location maps to show distances to the \_\_\_\_\_ from specific reference.
- A. Valve(s)                      D. House  
 B. Stoneline                      E. Telephone pole  
 C. Monument                    F. None of the Above
24. Globe valve, a rotary valve is rare to find in most distribution systems, but can be found at treatment plants.
- A. True            B. False
25. Most Globes have compact OS & Y type, bolted bonnet, rising stems, with renewable seat rings.
- A. True            B. False
26. Newer water systems are frequently expanded with planning and developed into a tree-like system.
- A. True            B. False
27. The Tree system consists of a single main that \_\_\_\_\_ as it leaves the source and progresses through the area originally served.
- A. Be isolated                      D. Limits the expansion  
 B. Connect individual buildings    E. Decreases in size  
 C. By laying out                    F. None of the Above
28. Smaller pipelines \_\_\_\_\_ the main and divide again, much like the trunk and branches of a tree.
- A. Branch off                      D. Limit the expansion  
 B. Are manifolded to                E. Decrease  
 C. Connect                         F. None of the Above
29. According to the text, there are several advantages gained by laying out water mains in a loop or grid, with feeder and distributor mains interconnecting at roadway intersections and other regular intervals.
- A. True            B. False
30. The damaged section can be isolated and the remainder of the system will still carry pressure, water will not be distributed if a single section fails.
- A. True            B. False
31. During periods of peak fire flow demand, there will be less impact from \_\_\_\_\_ in water mains as the velocity within any given section of main.
- A. Carrying capacity    D. Static pressure  
 B. Friction loss            E. Total pressure  
 C. Pressure                      F. None of the Above

**Types of Pipes Used in the Water Distribution Field**

**Plastic Pipe (PVC)**

32. Plastic pipe has seen extensive use available in different lengths and sizes, it is lighter than steel or copper and requires no special tools to install.
- A. True            B. False

### Cast Iron (CIP)

33. Advantages of CIP are its long life, ability to withstand shock loads and to withstand working pressures up to 120 psi.

- A. True      B. False

### Ductile Iron Pipe (DIP)

34. DIP can be purchased in 4" to 45" diameters and lengths of 18' to 20'.

- A. True      B. False

35. DIP was developed to \_\_\_\_\_ associated with cast iron pipe.

- A. Overcome the breakage problems      D. Provide a High C Factor  
B. Withstand shock loads      E. Be nearly indestructible  
C. Extend the life      F. None of the Above

36. DIP's main advantage is that it is \_\_\_\_\_ by internal or external pressures.

- A. Overcome the breakage problems      D. Provide a High C Factor  
B. Withstand shock loads      E. Nearly indestructible  
C. Extend the life      F. None of the Above

### Water Production/Treatment System - Groundwater Production and Treatment System Groundwater and Wells

37. According to the text, toxic material spilled or dumped near a well can leach into which of the following terms and contaminate the groundwater drawn from that well?

- A. Unconfined aquifer(s)      D. Well(s)  
B. Groundwater      E. Aquifer  
C. Water table      F. None of the Above

### Contaminated Wells

38. Which of the following terms can be tested to see what chemicals may be in the well and if they are present in dangerous quantities?

- A. Wells      D. Soil moisture  
B. Drinking water      E. Karst  
C. Water table      F. None of the Above

39. Groundwater is withdrawn from wells to provide water when water is pumped from the ground, which of the following terms change in response to this withdrawal?

- A. Dynamics of groundwater flow      D. Well(s)  
B. Groundwater      E. Aquifer  
C. Water table      F. None of the Above

40. Which of the following terms flows slowly through water-bearing formations at different rates?

- A. Well      D. Soil moisture  
B. Drinking water      E. Groundwater  
C. Water table      F. None of the Above

## Aquifer

41. Many terms are used to describe the nature and extent of the groundwater resource, the level below which all the spaces are filled with water is called the?

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

42. Above the water table lies the?

- A. Unsaturated zone
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Karst
- F. None of the Above

43. The entire region below the water table is called the saturated zone and water in this saturated zone is called?

- A. Unconfined aquifer(s)
- B. Groundwater
- C. Water table
- D. Well(s)
- E. Aquifer
- F. None of the Above

44. Clay has many spaces between its grains, but the spaces are not large enough to permit free movement of water.

- A. True
- B. False

45. Which of the following terms usually flows downhill with the slope of the water table?

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

46. Which of the following terms flow in the aquifers underlying springs or surface drainage basins, and does not always mirror the flow of water on the surface?

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

47. Which of the following terms may move in different directions below the ground than the water flowing on the surface?

- A. Well
- B. Drinking water
- C. Water table
- D. Soil moisture
- E. Groundwater
- F. None of the Above

48. Unconfined aquifers are those that are bounded by the water table. Some aquifers lie beneath layers of impermeable materials.

- A. True
- B. False

49. A well in such an aquifer is called an artesian well.

- A. True
- B. False

50. Which of the following terms is the level to which the water in an artesian aquifer will rise?
- A. Unconfined aquifer(s)
  - B. Piezometric surface
  - C. Water table
  - D. Well(s)
  - E. Aquifer
  - F. None of the Above

**Cone of Depression**

51. The water level in the well falls below the water table in the?
- A. Water table
  - B. Groundwater
  - C. Surrounding aquifer
  - D. Cone of depression
  - E. Well
  - F. None of the Above
52. The movement of water from this term into a well results in the formation of a cone of depression.
- A. Confined aquifer
  - B. An aquifer
  - C. Hydrologic cycle
  - D. Water table
  - E. Unconfined aquifer
  - F. None of the Above
53. Which of the following terms describes a three-dimensional inverted cone surrounding the well that represents the volume of water removed as a result of pumping?
- A. Water table
  - B. Groundwater
  - C. Gravity
  - D. Cone of depression
  - E. Well
  - F. None of the Above
54. Which of the following terms 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. Water table
  - B. Groundwater
  - C. Drawdown
  - D. Cone of depression
  - E. Well
  - F. None of the Above
55. When pumping begins, water begins to flow towards the well in contrast to the natural direction of groundwater movement.
- A. True
  - B. False
56. When a well is installed in this missing term, 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
  - B. Aquifer(s)
  - C. Hydrologic cycle
  - D. Water table
  - E. An unconfined aquifer
  - F. None of the Above

**Where Is Ground Water Stored?**

57. Areas where ground water exists in sufficient quantities to supply wells or springs are called aquifers, a term that literally means?
- A. Water table
  - B. Groundwater
  - C. Water bearer
  - D. Cone of depression
  - E. Well
  - F. None of the Above

58. Which of the following terms store water in the spaces between particles of sand, gravel, soil, and rock as well as cracks, pores, and channels in relatively solid rocks?

- A. Confined aquifer
- B. Aquifer(s)
- C. Hydrologic cycle
- D. Water table
- E. Unconfined aquifer
- F. None of the Above

59. 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

60. There are two kinds of aquifers: confined and unconfined.

- A. True
- B. False

61. 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

62. 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

63. 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?

64. 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

65. 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)
- B. Saturated zone
- C. Karst aquifer(s)
- D. Water soluble limestone
- E. Serious contamination source(s)
- F. None of the Above

### Ground-Water Quality

66. 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

### Waterborne Pathogens and Disease Section

67. Most pathogens are generally associated with diseases that \_\_\_\_\_ and affect people in a relatively short amount of time, generally a few days to two weeks.
- A. Limits the treatment process
  - B. Are mild in nature
  - C. Cause intestinal illness
  - D. Will cause fatalities
  - E. Limit the travel of pathogens
  - F. None of the Above

### How Diseases are Transmitted.

68. Waterborne pathogens are primarily spread by the?
- A. Fecal-oral, or feces-to-mouth, route
  - B. Dermal to fecal route
  - C. Oral to fecal route
  - D. Influenza route
  - E. Waterborne mishaps
  - F. None of the Above
69. When infected humans or animals pass the bacteria, viruses, and \_\_\_\_\_ in their stool, pathogens may get into water and spread disease.
- A. Fecal Coliform and E coli
  - B. Protozoa
  - C. Macroorganisms
  - D. Cryptosporidiosis
  - E. Bioslime
  - F. None of the Above
70. For another person to become infected, he or she must take the pathogen in through the mouth.
- A. True
  - B. False

### Protozoan Caused Diseases

71. Which of the following bugs is larger than bacteria and viruses but still microscopic; they invade and inhabit the gastrointestinal tract?
- A. HIV infections
  - B. Symptoms
  - C. Giardiasis
  - D. Hepatitis A
  - E. Protozoan pathogens
  - F. None of the Above
72. A few of the parasites enter the environment in a dormant form, with a protective cell wall, called a?
- A. Lamblia
  - B. Shell
  - C. Case
  - D. Cyst
  - E. Infection
  - F. None of the Above
73. Which of the following terms can survive in the environment for long periods of time and is extremely resistant to conventional disinfectants such as chlorine?
- A. HIV
  - B. Symptoms
  - C. Infection
  - D. Hepatitis A cyst
  - E. Cyst
  - F. None of the Above
74. Which of the following terms is a commonly reported protozoan-caused disease, it has also been referred to as backpacker's disease?
- A. Giardia lamblia
  - B. Giardiasis
  - C. Malaise
  - D. Cryptosporidiosis
  - E. Anti-water Infection
  - F. None of the Above

75. The backpacker's disease incubation period is 5-25 days or longer, with an average of 7-10 days, many infections are \_\_\_\_\_.

- A. Total
- B. Weak
- C. Strong
- D. Asymptomatic
- E. Unisymptomatic
- F. None of the Above

76. Which of the following bugs/disease terms occurs worldwide primarily because customers are receiving their drinking water from streams or rivers without adequate disinfection or a filtration system?

- A. HIV infections
- B. Symptoms
- C. Giardiasis
- D. Hepatitis A symptoms
- E. Cryptosporidiosis symptoms
- F. None of the Above

### **Giardia lamblia**

77. Which of the following bugs has been responsible for more community-wide outbreaks of disease in the U.S. than any other, drug treatment is not 100% effective?

- A. HIV infection
- B. Giardia lamblia
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

### **Cryptosporidiosis**

78. The mode of transmission of this bug is fecal-oral, either by person-to-person or animal-to-person, there is no specific treatment.

- A. HIV infection
- B. Giardia lamblia
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

79. All of these diseases, with the exception of this bug, have one symptom in common: diarrhea. They also have the same mode of transmission, fecal-oral, whether through person-to-person or animal-to-person contact.

- A. HIV infection
- B. Giardia lamblia
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

80. Which of the following is an example of a protozoan disease that is common worldwide, but was only recently recognized as causing human disease?

- A. HIV infection
- B. Giardia lamblia symptom
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

81. Which of the following usually come and go, and end in fewer than 30 days in most cases, the incubation period is 1-12 days, with an average of about seven days?

- A. HIV infections
- B. Symptoms
- C. Giardiasis
- D. Hepatitis A
- E. Cryptosporidiosis
- F. None of the Above

### **Bacteriological Monitoring Section**

82. Which of the following are usually harmless, occur in high densities in their natural environment and are easily cultured in relatively simple bacteriological media?

- A. Indicator bacteria
- B. Bacteria tests
- C. Contaminate
- D. Microbiological analysis
- E. Presence of an indicator
- F. None of the Above

83. The presence of an indicator or \_\_\_\_\_ in your drinking water is an important health concern.

- A. Indicator bacteria
- B. Pathogenic bacteria
- C. Contaminate
- D. Microbiological analysis
- E. Presence of an indicator
- F. None of the Above

84. Which of the following terms is used to signal possible fecal contamination, and therefore, the potential presence of pathogens?

- A. Indicator bacteria
- B. Pathogenic bacteria
- C. Contaminate
- D. Microbiological analysis
- E. Presence of an indicator
- F. None of the Above

85. Indicators in common use today for routine monitoring of drinking water include total coliforms, fecal coliforms, and?

- A. Sample container
- B. Bacteria tests
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Iron bacteria
- F. None of the Above

86. According to the text, the routine microbiological analysis of your water is for?

- A. Indicator bacteria
- B. Bacteria tests
- C. Contamination
- D. Coliform bacteria
- E. Presence of an indicator
- F. None of the Above

87. Which of the following terms is used as an indicator organism to determine the biological quality of your water?

- A. Microbiological analysis
- B. Bac-T
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Presence of an indicator
- F. None of the Above

### **Bacteria Sampling**

88. Water samples for this process must always be collected in a sterile container.

- A. Indicators
- B. Bacteria tests
- C. Contamination
- D. pH analysis
- E. Presence of an indicator
- F. None of the Above

89. Refrigerate the sample and transport it to the testing laboratory within eight hours (in an ice chest). Many labs will accept bacteria samples on Friday. Mailing Indicator bacteria is not recommended because laboratory analysis results are not as reliable.

- A. True
- B. False

90. Which bug forms an obvious slime on the inside of pipes and fixtures? A water test is not needed for identification. Check for a reddish-brown slime inside a toilet tank or where water stands for several days.

- A. Colonies
- B. Algae
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Iron bacteria
- F. None of the Above

91. Which of the following are common in the environment and are generally not harmful, but the presence of these bacteria in drinking water is usually a result of a problem with the treatment system or the pipes that distribute water, and indicates that the water may be contaminated with germs that can cause disease.

- A. Diseases
- B. Germs
- C. Coliform bacteria
- D. Escherichia coli (E. coli)
- E. Iron bacteria
- F. None of the Above

### Laboratory Procedures

92. The laboratory may perform the \_\_\_\_\_ in one of four methods approved by the U.S. EPA and your local environmental or health division.

- A. Colilert
- B. Coliform
- C. Sample time
- D. Total coliform analysis
- E. Pathogen test
- F. None of the Above

### Methods

93. The MMO-MUG test, a product marketed as \_\_\_\_\_, is the most common. The sample results will be reported by the laboratories as simply coliforms present or absent.

- A. Colilert
- B. Coliform
- C. Sample stuff
- D. Total coliform analysis
- E. Pathogen media
- F. None of the Above

94. If coliforms are present, the laboratory will analyze the sample further to determine if these are \_\_\_\_\_ and \_\_\_\_\_ and report their presence or absence.

- A. Colilert, E. coli
- B. Coliforms, E. coli
- C. Fecal coliforms, E. coli
- D. Total coliform analysis, Pathogens
- E. Pathogens, Total coliform analysis
- F. None of the Above

### Types of Water Samples

95. It is important to properly identify the type of \_\_\_\_\_ you are collecting.

- A. Colilert
- B. Coliforms
- C. Sample
- D. Total coliform analysis
- E. Pathogens
- F. None of the Above

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

96. 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. QA QC
- D. Total coliform analysis
- E. Routine
- F. None of the Above

97. What type of samples can be collected for other reasons? Examples would be a sample collected after repairs to the system.

- A. Repeat
- B. Special
- C. Sample
- D. Total coliform analysis
- E. Routine
- F. None of the Above

98. What type of samples can be collected on a routine basis to monitor for contamination? Collection should be in accordance with an approved sampling plan.

- A. Repeat
- B. Special
- C. Sample
- D. Total coliform analysis
- E. Routine
- F. None of the Above

### Repeat Sampling

99. Which of the following terms is total coliform or fecal coliform present, a set of repeat samples must be collected within 24 hours after being notified by the laboratory?

- A. MCL compliance
- B. Distribution system
- C. Routine sample
- D. Original sampling location
- E. Repeat sample(s)
- F. None of the Above

### The follow-up for repeat sampling is:

100. If only one \_\_\_\_\_ per month or quarter is required, four (4) repeat samples must be collected.

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

101. For systems collecting two (2) or more routine samples per month, three (3) \_\_\_\_\_ must be collected.

- A. Compliance sample
- B. Distribution sample
- C. Routine sample
- D. QA/QC Split
- E. Repeat sample(s)
- F. None of the Above

102. Repeat samples must be collected from: Within five (5) service connections upstream from the?

- A. MCL compliance
- B. Distribution system
- C. Routine sample
- D. Original sampling location
- E. Repeat sample(s)
- F. None of the Above

103. Repeat samples must be collected from: Within five (5) service connections downstream from the?

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

104. Repeat samples must be collected from: If the system has only one service connection, the \_\_\_\_\_ must be collected from the same sampling location over a four-day period or on the same day.

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

105. Repeat samples must be collected from: All \_\_\_\_\_ are included in the MCL compliance calculation.

- A. Special Sample
- B. Routine sample
- C. Repeat sample(s)
- D. Coliform present
- E. Original sampling location
- F. None of the Above

### Sampling Procedures

106. Which term must be followed and all operating staff must be clear on how to follow the sampling plan?

- A. Seal individual samples
- B. Chain of custody
- C. Distribution system
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

107. Staff must be aware of how often sampling must be done, the \_\_\_\_\_ to be used for collecting the samples, and the proper procedures for identification, storage and transport of the samples to an approved laboratory.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Proper procedures and sampling containers
- E. Sampling containers
- F. None of the Above

108. In addition, proper procedures must be followed for repeat sampling whenever a routine sample result is?

- A. Seal individual samples
- B. Chain of custody
- C. Distribution system
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

### Maximum Contaminant Levels (MCLs)

109. State and federal laws establish standards for drinking water quality. Under normal circumstances when these guidelines are being met, the water is somewhat safe to drink with little threat to human health.

- A. True
- B. False

110. EPA had developed standards which are known as maximum contaminant levels (MCL). When a particular contaminant exceeds this term, a potential health threat may occur.

- A. Coliform bacteria count
- B. MCL
- C. Standards
- D. HPC
- E. CFU
- F. None of the Above

111. This acronym generally expresses properties of the contaminants, risk assessments and factors, short-term (acute) exposure and long term (chronic) exposure.

- A. Coliform bacteria
- B. MCLs
- C. Standards
- D. HPC
- E. CFU
- F. None of the Above

112. When you as the operator take samples to ensure your water is in compliance with the MCL, there are two types of \_\_\_\_\_ for coliform bacteria.

- A. Coliform bacteria
- B. MCLs
- C. Standards
- D. MCL violations
- E. CFU
- F. None of the Above

113. Which of the following terms is for total coliform; the second is an acute risk to health violation characterized by the confirmed presence of fecal coliform or E. coli?
- A. Coliform bacteria
  - B. MCLs
  - C. Standards
  - D. MCL violations
  - E. CFU
  - F. None of the Above

### Chain of Custody Procedures

114. Which of the following terms begins when the sample containers are obtained from the laboratory? From this point on, a chain of custody record will accompany the sample containers.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Chain of custody record
- E. Sampling containers
- F. None of the Above

115. Each custody sample requires a \_\_\_\_\_ record and may require a seal. If you do not seal individual samples, then seal the containers in which the samples are shipped.

- A. Seal individual samples
- B. Chain of custody
- C. Distribution system
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

116. Because a sample is physical evidence, \_\_\_\_\_ procedures are used to maintain and document sample possession from the time the sample is collected until it is introduced as evidence.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. TCR
- E. Chain of custody
- F. None of the Above

117. If both parties involved in the transfer must sign, date and note the time on the chain of custody record, this is known as?

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. Samples transfer possession
- E. Sampling containers
- F. None of the Above

118. The recipient will then attach the \_\_\_\_\_ showing the transfer dates and times to the custody sheets. If the samples are split and sent to more than one laboratory, prepare a separate chain of custody record for each sample.

- A. Seal individual samples
- B. Chain of custody
- C. Shipping invoices
- D. Sample siting plan
- E. Positive for total coliform
- F. None of the Above

119. If the samples are delivered to after-hours night drop-off boxes, the custody record should note such \_\_\_\_\_ and be locked with the sealed samples inside sealed boxes.

- A. Multiple sources
- B. Sample siting plan
- C. Total coliform
- D. TCR
- E. A transfer
- F. None of the Above

### Positive or Coliform Present Results

120. According to the text, if you are notified of a positive test result you need to contact either the Drinking Water Program or your local county health department within 24 hours, or by the next business day after the?

- A. Results are reported to you
- B. Positive violation
- C. Repeat sampling immediately
- D. Sample violation
- E. MCL compliance violation
- F. None of the Above

121. Ideally speaking, your Drinking Water Program Agency should contract with health departments to provide \_\_\_\_\_ to water systems.

- A. Assistance
- B. Harassment
- C. Hostility
- D. Sample help
- E. Compliance calculation
- F. None of the Above

122. It is very important to initiate the \_\_\_\_\_ as the corrective measures will be based on those results.

- A. Storage and distribution
- B. Repeat sampling immediately
- C. Upgrading of the wellhead area
- D. Perform routine procedures
- E. Corrective measures
- F. None of the Above

### Heterotrophic Plate Count HPC

123. Heterotrophic Plate Count --- formerly known as the Standard plate count, is a procedure for estimating the number of live heterotrophic bacteria..

- A. True
- B. False

124. Colonies may arise from pairs, chains, clusters, or single cells, all of which are included in the term?

- A. Coliform bacteria units
- B. MCLs units
- C. Standards
- D. HPC units
- E. Colony-forming units
- F. None of the Above

### Spread Plate Method

125. During this method, colonies are on the \_\_\_\_\_ where they can be distinguished readily from particles and bubbles.

- A. Agar surface
- B. Surface growth area
- C. Top
- D. Bottom
- E. Material
- F. None of the Above

126. During the Spread Plate Method, colonies can be transferred quickly, and \_\_\_\_\_ easily can be discerned and compared to published descriptions.

- A. Colonies grow
- B. Surface growth
- C. Low counts
- D. Heterotrophic organisms will grow
- E. Colony morphology
- F. None of the Above

### Membrane Filter Method

127. This method permits testing large volumes of \_\_\_\_\_ and is the method of choice for low-count waters.

- A. Colonies
- B. Surface water
- C. Low-turbidity water
- D. Heterotrophic organisms
- E. MCL
- F. None of the Above

**Heterotrophic Plate Count (Spread Plate Method)**

128. Which of the following terms use inorganic carbon sources, this is in contrast to Heterotrophic organisms utilize organic compounds as their carbon source?

- A. Colonies
- B. Surface growth
- C. AGAR
- D. Heterotrophic organisms
- E. Autotrophic organisms
- F. None of the Above

129. Which of the following terms provides a technique to quantify the bacteriological activity of a sample?

- A. Colonies
- B. Heat
- C. Agar
- D. Heterotrophic Plate Count
- E. MCL
- F. None of the Above

130. The R2A agar provides a medium that will support a large variety of?

- A. Colonies
- B. Bugs
- C. Germs
- D. Heterotrophic bacteria
- E. MCL
- F. None of the Above

**Total Coliforms**

131. This MCL is based on the presence of total coliforms, and compliance is on a daily or weekly basis, depending on your water system type and state rule.

- A. True
- B. False

132. For systems that collect fewer than \_\_\_\_\_ samples per month, no more than one sample per month may be positive. In other words, the second positive result (repeat or routine) in a month or quarter results in a MCL violation.

- A. 5
- B. 10
- C. 100
- D. 200
- E. 40
- F. None of the Above

133. For systems that collect \_\_\_\_\_ or more samples per month, no more than five (5) percent may be Positive?

- A. 5
- B. 10
- C. 100
- D. 200
- E. 40
- F. None of the Above

**Acute Risk to Health (Fecal coliforms and E. coli)**

134. A(n) \_\_\_\_\_ to human health violation occurs if either one of the following happens:

- A. Routine analysis
- B. Drinking violation
- C. Acute risk
- D. Human health violation
- E. Fecal coliform or E. coli is present
- F. None of the Above

135. A routine analysis shows total coliform present and is followed by a repeat analysis which indicates \_\_\_\_\_.

- A. Routine analysis
- B. Drinking violation
- C. Water penalty
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

136. A routine analysis shows total and \_\_\_\_\_ is followed by a repeat analysis which indicates total coliform present.

- A. Routine analysis
- B. Drinking water violation
- C. MCL violation
- D. Human health violations
- E. Fecal coliform or E. coli present
- F. None of the Above

137. Which of the following terms requires the water system to provide public notice via radio and television stations in the area?

- A. Routine analysis violation
- B. Drinking water rule violation
- C. MCL violation
- D. Human health violation
- E. Acute health risk violation
- F. None of the Above

138. According to the text, the type of contamination can pose an immediate threat to human health and notice must be given as soon as possible, but no later than 24 hours after notification from your laboratory of the test results.

- A. True
- B. False

**Public Notice**

139. A public notice is required to be issued by a water system whenever it fails to comply with an applicable MCL or \_\_\_\_\_, or fails to comply with the requirements of any scheduled variance or permit.

- A. Routine analysis
- B. Drinking water rule
- C. Treatment technique
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

140. If there is a(n) \_\_\_\_\_ present to users, the timing and place of posting of the public notice may have different priorities.

- A. Routine analysis
- B. Drinking water rule
- C. Acute risk
- D. Human health violation
- E. Fecal coliform or E. coli present
- F. None of the Above

141. This term best describes what also is required whenever a water system fails to comply with its monitoring and/or reporting requirements or testing procedure.

- A. Routine analysis
- B. Drinking water rule
- C. MCL violation
- D. Public notice
- E. Fecal coliform or E. coli present count
- F. None of the Above

142. There shall be certain information, be issued properly and in a timely manner, and contain certain \_\_\_\_\_ on the public notice.

- A. Legal analysis
- B. Drinking water rule information
- C. NOVs
- D. Mandatory language
- E. Fecal language
- F. None of the Above

**The following are acute violations:**

143. Which is violation of nitrate?

- A. Presence
- B. MCL
- C. MCLG
- D. Count
- E. Acute violations
- F. None of the Above

144. Concerning total coliforms - when fecal coliforms or E. coli are present in the distribution system and is a violation of the?

- A. Presence
- B. MCL
- C. MCLG
- D. Count
- E. Acute violations
- F. None of the Above

145. Any outbreak of \_\_\_\_\_, as defined by the rules.

- A. Total coliforms
- B. MCL
- C. Waterborne disease
- D. Radioactive bacteria
- E. Acute violations
- F. None of the Above

### Chlorine Section

146. When chlorine is added into the water stream, chlorine hydrolyzes into?

- A. HCL
- B. Sodium hypochlorite
- C. Bromoform
- D. Chlorine Acid
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

147. When chlorine hydrolyzation occurs, it provides an active toxicant, \_\_\_\_\_, which is pH-dependent. In alkaline cooling systems, it readily dissociates to form the hypochlorite ion (OCI-).

- A. HCl
- B. HOCl
- C. High chlorine concentrations
- D. pH of 7.0 than at pH 8.5
- E. The hypochlorite ion (OCI-)
- F. None of the Above

148. In alkaline conditions, this missing term becomes the predominant species and lacks the biocidal efficacy of the non-dissociated form.

- A. Chlorine
- B. Sodium hypochlorite
- C. OCI-
- D. Chlorine gas
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

149. Considerably more \_\_\_\_\_ is present at a pH of 7.0 than at pH 8.5.

- A. HCl
- B. HOCl
- C. High chlorine concentrations
- D. Alkanitinity
- E. Hypochlorite ion (OCI-)
- F. None of the Above

150. Chlorine can be non-selective, making it very sensitive to contamination from either cooling water makeup or from in-plant process leaks. \_\_\_\_\_, organic acids and organic compounds, sulfides, iron and manganese all easily react with HOCl.

- A. Chlorine
- B. Sodium hypochlorite
- C. Ammonia
- D. Chlorine gas
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

151. What is the term that best describes the amount of chlorine needed to react with contamination species and it must be satisfied before active HOCl is available to provide a free chlorine residual?

- A. Chlorine demand
- B. HOCl
- C. High chlorine concentration
- D. Total residual
- E. The hypochlorite ion (OCI-)
- F. None of the Above

152. The combination of high chlorine demand in process-contaminated systems and the dissociation process in alkaline systems creates the need for greater chlorine feed to obtain the same microbial efficacy. This results in a higher concentration of HCl in the cooling system.

A. True B. False

153. Which of the following terms removes alkalinity, pH depression and system corrosion could occur?

- A. HCl
- B. HOCl
- C. High chlorine concentrations
- D. pH of 7.0 than at pH 8.5
- E. The hypochlorite ion (OCI-)
- F. None of the Above

154. Which of the following terms can damage or penetrate the passive oxide layer, leading to localized damage of the metal surface?

- A. Chlorine
- B. Sodium hypochlorite
- C. The chloride ion (Cl<sup>-</sup>)
- D. Chlorine gas
- E. Hypochlorous acid (HOCl), and hydrochloric acid (HCl)
- F. None of the Above

155. High chlorine concentrations have also been shown to directly attack traditional organic-based corrosion inhibitors. When these inhibitors are "deactivated," the metal surface would then be susceptible to corrosion. Process Safety Management (PSM) guidelines dictated by the U.S. Occupational Safety and Health Administration (OSHA), discharge problems related to Chlorinated organic compounds such as trihalomethane (THM), dezincification of admiralty brass and delignification of cooling tower wood are other significant concerns associated with the use of chlorine.

A. True B. False

### Pathophysiology

156. As far as chlorine safety and respiratory protection, the intermediate \_\_\_\_\_ of chlorine accounts for its effect on the upper airway and the lower respiratory tract.

- A. Generation of free oxygen radicals
- B. Vapor from Chlorine gas
- C. Effects of Hydrochloric acid
- D. Water solubility
- E. The odor threshold for chlorine
- F. None of the Above

157. According to the text, respiratory exposure to \_\_\_\_\_ may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes.

- A. Hydrochloric acid
- B. Chlorine gas
- C. The gas
- D. The chemical species produced
- E. Plasma exudation
- F. None of the Above

158. Because chlorine gas is so dangerous, the odor threshold for chlorine is approximately?

- A. 1 parts per million (ppm)
- B. 3 parts per million (ppm)
- C. 10 parts per million (ppm)
- D. 3-5 parts per million (ppm)
- E. 0.3-0.5 parts per million (ppm)
- F. None of the Above

### Mechanism of Activity

159. The mechanisms of cellular injury are believed to result from the oxidation of functional groups in cell components, from reactions with tissue water to form \_\_\_\_\_, and from the generation of free oxygen radicals.

- A. Generation of free oxygen radicals
- B. Chlorine acid
- C. Hydrochloric acid
- D. A caustic effect
- E. Hypochlorous and hydrochloric acid
- F. None of the Above

160. Chlorine gas feeds out of the cylinder through a gas regulator. The cylinders are on a scale that operators use to measure the amount used each day. The chains are used to prevent the tanks from falling over.

A. True B. False

161. Chlorine gas should be stored in vented rooms that have panic bar equipped doors.

A. True B. False

### Solubility Effects

162. Which of the following terms is highly soluble in water?

- A. Hydrochloric acid
- B. H<sub>2</sub>SO<sub>4</sub>
- C. Hypochloric acid
- D. Sodium hypochlorite solution
- E. Sulfuric Acid
- F. None of the Above

163. Because it is highly water soluble, Hypochlorous acid has an injury pattern similar to?

- A. Hydrochloric acid
- B. H<sub>2</sub>SO<sub>4</sub>
- C. Hypochloric acid
- D. Sodium hypochlorite solution
- E. Sulfuric Acid
- F. None of the Above

164. Which of the following terms may account for the toxicity of elemental chlorine and hydrochloric acid to the human body?

- A. Hydrochloric acid
- B. H<sub>2</sub>SO<sub>4</sub>
- C. Hypochloric acid
- D. Hypochlorous acid
- E. Sulfuric Acid
- F. None of the Above

### Pathological Findings

165. According to the text, treatment plants use \_\_\_\_\_ to reduce water levels of microorganisms that can spread disease to humans.

- A. HCl
- B. HOCl
- C. High chlorine concentrations
- D. Chlorine
- E. The hypochlorite ion (OCI<sup>-</sup>)
- F. None of the Above

### Exposure

166. There is no threshold value for to sodium hypochlorite exposure. Various health effects occur after exposure to sodium hypochlorite.

A. True B. False

### Chemistry of Chlorination

167. The hypochlorite ion is a much weaker disinfecting agent than Hypochlorous acid , about 100 times less effective.

A. True B. False

168. According to the text, pH and temperature affect the ratio of hypochlorous acid to hypochlorite ions. As the temperature is decreased, the \_\_\_\_\_ increases.

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. Ratio of hypochlorous acid
- F. None of the Above

169. Hypochlorous acid is a strong acid but a weak disinfecting agent. The amount of hypochlorous acid depends on the pH and temperature of the water.

- A. True
- B. False

**Types of Residual**

170. \_\_\_\_\_ is all chlorine that is available for disinfection.

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine
- D. Break-point chlorination
- E. Total chlorine
- F. None of the Above

171. Which of the following terms is a much stronger disinfecting agent, therefore, most water regulating agencies will require that your daily chlorine residual readings be of free chlorine residual?

- A. Free chlorine
- B. Total residual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. T10 of the process unit
- F. None of the Above

172. Which of the following terms is where the chlorine demand has been satisfied, and any additional chlorine will be considered free chlorine?

- A. Chlorine residual
- B. Chlorine demand
- C. Free chlorine
- D. Break-point chlorination
- E. Total chlorine residual
- F. None of the Above

**Residual Concentration/Contact Time (CT) Requirements**

173. Since monitoring for very low levels of pathogens in treated water is analytically very difficult, utilizing the \_\_\_\_\_ is recommended to demonstrate satisfactory treatment.

- A. Free chlorine
- B. Total residual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. T10 of the process unit
- F. None of the Above

174. \_\_\_\_\_ = Concentration (mg/L) x Time (minutes)

- A. CT
- B. The amount of chlorine
- C. Chlorine Demand
- D. Total chlorine
- E. pH value and temperature
- F. None of the Above

175. The effective reduction in pathogens can be calculated by reference to standard tables of required?

- A. Free chlorine
- B. Total residual
- C. Free chlorine residual
- D. "CT" s
- E. T10 of the process unit
- F. None of the Above

**Calculation and Reporting of CT Data**

176. Reduction Ratio should be reported, along with the appropriate pH, temperature, and?

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. Disinfectant residual
- E. T10 of the process unit
- F. None of the Above

177. Which of the following terms must be greater than 1.0 to be acceptable?

- A. Reduction Ratio
- B. CT actual
- C. Free chlorine residual
- D. "CT" disinfection concept
- E. T10 of the process unit
- F. None of the Above

### Chlorine (DDBP)

178. According to the text, this type of chlorine residual concentration residuals from 0.1 to 0.5 ppm.

- A. Free available chlorine and Total
- B. Residual
- C. Break point and Free
- D. Free available
- E. Combined chlorine and readily available
- F. None of the Above

179. A typical chlorine residual is 2 ppm for this type of chlorine residual?

- A. Free available chlorine and Total
- B. Residual
- C. Break point and Free
- D. Combined Chlorine
- E. Combined chlorine and readily available
- F. None of the Above

### Chlorine By-Products

180. The most common chlorination by-products found in U.S. drinking water supplies are?

- A. Chlorate and Chlorite
- B. CO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub>
- C. Trihalomethanes (THMs)
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

### The Principal Trihalomethanes are:

181. Chloroform, bromodichloromethane, chlorodibromomethane, and bromoform. Other less common chlorination by-products include the haloacetic acids and haloacetonitriles. The amount of THMs formed in drinking water can be influenced by a number of factors, including the season and the source of the water.

- A. True B. False

182. THM concentrations are generally higher in winter than in summer, because concentrations of natural organic matter are greater and more chlorine is required to disinfect at colder temperatures.

- A. True B. False

### Health Effects

183. The available studies on health effects do not provide conclusive proof of a relationship between exposure to THMs and cancer or reproductive effects, but indicate the need for further research to confirm their results and to assess the potential health effects of chlorination by-products other than THMs.

- A. True B. False

### Risks and Benefits of Chlorine

184. Many cities utilize the use of ozone to disinfect their source water and to reduce formation of this parameter?

- A. Chlorate and Chlorite
- B. CO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub>
- C. Trihalomethanes (THMs)
- D. Ammonia and THMS
- E. Chloramines
- F. None of the Above

185. \_\_\_\_\_ is a highly effective disinfectant; it breaks down quickly, so that small amounts of \_\_\_\_\_ or other disinfectants must be added to the water to ensure continued disinfection as the water is piped to the consumer's tap.

- A. Ozone, Chlorine
- B. UV, Chlorine
- C. Chlorite, Chlorine
- D. Chlorine Dioxide, Chlorine
- E. Chloramines, Chlorine
- F. None of the Above

### Chlorine's Gas Appearance and Odor

186. Prolonged exposures to chlorine gas may result in?

- A. Exposure to chlorine
- B. Odor thresholds
- C. A corrosive material
- D. Olfactory fatigue
- E. Moisture, steam, and water
- F. None of the Above

### Chlorination Equipment Requirement Section

187. A chlorine room is where chlorine gas cylinders and/or ton containers are?

- A. Under pressure
- B. In this stage
- C. Stored
- D. At the point of solution application
- E. Dosing enough chlorine
- F. None of the Above

188. Which of the following shall be included in the gas vacuum line between the vacuum regulator(s) and the chlorinator(s) to ensure that pressurized chlorine gas does not enter the gas vacuum lines leaving the chlorine room?

- A. Gas vacuum line
- B. A gas pressure relief system
- C. Manual chlorine feed systems
- D. Mechanical gas proportioning equipment
- E. Post chlorination
- F. None of the Above

189. Which of the following shall have positive shutdown in the event of a break in the downstream vacuum lines?

- A. Gas vacuum line
- B. A gas pressure relief system
- C. Manual chlorine feed systems
- D. Mechanical gas proportioning equipment
- E. The vacuum regulating valve(s)
- F. None of the Above

### Capacity

190. Which of the following shall have the capacity to dose enough chlorine to overcome the demand and maintain the required concentration of the "free" or "combined" chlorine.

- A. The chlorinator
- B. Constant flow rate(s)
- C. Uninterrupted chlorination
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

### Methods of Control

191. Which of the following shall be automatic proportional controlled, automatic residual controlled, or compound loop controlled?

- A. A chlorine feed system
- B. Constant flow rate(s)
- C. Uninterrupted chlorination
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

192. Which piece if chlorination equipment may be installed for groundwater systems with constant flow rates?

- A. Manual chlorine feed systems
- B. Constant flow rate(s)
- C. Uninterrupted chlorination
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

### Standby Provision

193. For uninterrupted chlorination, \_\_\_\_\_ shall be equipped with an automatic changeover system. In addition, spare parts shall be available for all chlorinators.

- A. Flow change(s)
- B. Constant flow rate(s)
- C. Gas chlorinators
- D. Automatic proportional controlled
- E. Constant pre-established dosage
- F. None of the Above

### **Weigh Scales**

194. Scales for weighing cylinders shall be provided at all plants using chlorine gas to permit an accurate reading of total daily weight of chlorine used. At large plants, scales of the recording and indicating type are recommended.

- A. True B. False

### **Securing Cylinders**

195. All chlorine cylinders shall be securely positioned to safeguard against movement. Tag the cylinder "empty" and store flat and chained. Ton containers may be stacked.

- A. True B. False

### **Chlorine Leak Detection**

196. Which of the following related chlorine alarm equipment shall be installed at all water treatment plants using chlorine gas? Leak detection shall be provided for the chlorine rooms.

- A. Caustic soda solution reaction tanks                      D. Automatic chlorine leak detection  
B. Corrosion resistant    E. Chlorine room ventilation system  
C. Securely positioned    F. None of the Above

197. Which of the following related chlorine alarm equipment should be connected to a remote audible and visual alarm system and checked on a regular basis to verify proper operation.

- A. The chlorinator    D. The chlorine gas leakage  
B. The facility    E. Chlorine leak detection equipment  
C. All chlorine cylinders    F. None of the Above

198. You can use a spray solution of ammonia or a rag soaked with sulfur dioxide to detect a small Cl<sub>2</sub> leak. If there is a leak, the sulfur dioxide will create a white colored smoke - Sulfuric chloride.

- A. True B. False

### **Chlorine Room Design Requirements**

199. The chlorinator may or may not be located inside?

- A. The chlorinator    D. The chlorine room  
B. The facility    E. Chlorine leak detection equipment  
C. All chlorine cylinders    F. None of the Above

### **Ventilation**

200. Which chlorine safety related equipment term should be outside the room at all entrance or viewing points, and a clear wire-reinforced glass window shall be installed in such a manner as to allow the operator to inspect from the outside of the room?

- A. Gas chlorine room    D. Automatic chlorine leak detection  
B. The chlorine room    E. Separate switches for fans and lights  
C. Chlorine room ventilation system                          F. None of the Above

### **Heating**

201. Which chlorine safety related equipment term shall be protected to ensure that the chlorine maintains its gaseous state when entering the chlorinator?

- A. Cylinders or containers    D. Automatic chlorine leak detection  
B. Corrosion resistant    E. Chlorine room ventilation system  
C. Securely positioned    F. None of the Above

### Storage of Chlorine Cylinders

202. Sometimes entry in very large facilities, may be through a vestibule from outside in to ?
- A. Cylinders or containers access
  - B. The outside of the room
  - C. Chlorine rooms
  - D. Uncontrolled release of spilled gas
  - E. Air inlets
  - F. None of the Above

### Scrubbers

203. According to the text, facilities located within residential or densely populated areas, consideration shall be given to provide scrubbers for\_\_\_\_\_.

- A. A panic button
- B. The chlorine room
- C. Scrubber(s)
- D. The chlorine gas storage room
- E. The chlorine cylinder storage room
- F. None of the Above

204. Which term means the amount of chlorine required to produce a residual of 0.1 mg/l after a contact time of fifteen minutes as measured by iodometric method of a sample at a temperature of twenty degrees in conformance with Standard methods.

- A. Combined residual
- B. Free chlorine residual
- C. Chlorine Demand
- D. Total chlorine
- E. Break point chlorination
- F. None of the Above

### Disinfection Byproduct Regulations Summary

205. Regulators and the general public have focused greater attention on potential health risks from chemical contaminants in drinking water. One such concern relates to disinfection byproducts (DBPs), chemical compounds formed unintentionally when chlorine and other disinfectants react with certain inorganic matter in water.

- A. True B. False

206. Water system managers may also consider switching from chlorine to alternative disinfectants to reduce formation of THMs and HAAs.

- A. True B. False

207. All chemical disinfectants form some DBPs. Much less is known about the byproducts of these alternatives than is known about chlorination byproducts. Furthermore, each disinfection method has other distinct advantages and disadvantages.

- A. True B. False

### Ozone

208. Which compound is obtained by passing a flow of air or oxygen between two electrodes that are subjected to an alternating current in the order of 10,000 to 20,000 volts?

- A. Chloramine
- B. Liquid Ozone
- C. Ozone
- D. Oxygen and nascent oxygen
- E. O<sub>2</sub>
- F. None of the Above

209. Which compound is a light blue gas at room temperature?

- A. Chloramine
- B. Liquid Ozone
- C. Ozone
- D. Oxygen and nascent oxygen
- E. O<sub>2</sub>
- F. None of the Above

210. Ozone has a \_\_\_\_\_ similar to that sometimes noticed during and after heavy electrical storms. In use, ozone breaks down into oxygen and nascent oxygen.

- A. Self-policing pungent odor
- B. THMs
- C. Light blue gas
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

211. Ozone does not form chloramines or \_\_\_\_\_, and while it may destroy some THMs, it may produce others when followed by chlorination.

- A. Carcinogens
- B. THMs
- C. Complete disinfectant
- D. Oxygen and nascent oxygen
- E. Flocculation and coagulation
- F. None of the Above

212. Ozone falls into the same category as other disinfectants in that it can produce \_\_\_\_\_.

- A. Carcinogens
- B. THMs
- C. DBPs
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

213. Which compound is very unstable and can readily explode? As a result, it is not shipped and must be manufactured on-site.

- A. Chloramine
- B. Liquid Ozone
- C. Ozone
- D. Oxygen and nascent oxygen
- E. O<sub>2</sub>
- F. None of the Above

214. Each water has its own \_\_\_\_\_, in the order of 0.5 ppm to 5.0 ppm.

- A. Carcinogens
- B. THMs
- C. Ozone demand
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

### Alternate Disinfectants Section Summary

#### Chloramines

215. This compound is a very weak disinfectant for Giardia and virus reduction. It is recommended that it be used in conjunction with a stronger disinfectant. It is best utilized as a stable distribution system disinfectant.

- A. Chlorine
- B. Chloramine
- C. Ozone
- D. Oxygen and nascent oxygen
- E. Strongest oxidizing agent
- F. None of the Above

216. In the production of chloramines, the ammonia residuals in the finished water, when fed in excess of stoichiometric amount needed, should be limited to inhibit growth of?

- A. Cryptosporidium
- B. Chlorine-based disinfectants
- C. Giardia lamblia
- D. An emerging parasitic protozoan pathogen
- E. Nitrifying bacteria
- F. None of the Above

#### Chlorine Dioxide

217. Chlorine dioxide may be used for either taste and odor control or as?

- A. Post disinfectant
- B. ClO<sub>2</sub>/chlorite/chlorate
- C. An oxidant
- D. Total residual oxidants
- E. A pre-disinfectant
- F. None of the Above

**Pump, Motor and Hydraulic Section**  
**Common Hydraulic Terms**

218. Which of the following definitions is the engineering science pertaining to liquid pressure and flow?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

219. Which of the following definitions is the application of continuous force by one body upon another that it is touching; compression?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

220. Which of the following definitions is the force per unit area, usually expressed in pounds per square inch?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

221. Which of the following definitions is the pressure differential above or below ambient atmospheric pressure?

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Hydraulics
- D. Pressure, Gauge
- E. Pascal's Law
- F. None of the Above

222. 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. Hydraulics
- E. Hydrokinetics
- F. None of the Above

223. Which of the following definitions is often used to indicate gauge pressure?

- A. Head, Friction
- B. Head, static
- C. Head
- D. Hydraulics
- E. Hydrokinetics
- F. None of the Above

224. Which of the following definitions is the engineering science pertaining to the energy of liquid flow and pressure?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

225. Which of the following definitions is the pressure applied to a confined fluid at rest is transmitted with equal intensity throughout the fluid?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

226. Which of the following definitions is the height of a column or body of fluid above a given point?

- A. Head, Friction
- B. Head, static
- C. Head
- D. Hydraulics
- E. Hydrokinetics
- F. None of the Above

227. Which of the following definitions is the pressure exerted by the atmosphere at any specific location?

- A. Pressure, Atmospheric
- B. Pressure, Static
- C. Hydraulics
- D. Pressure, Gauge
- E. Pascal's Law
- F. None of the Above

228. Which of the following definitions is pressure above zone absolute, i.e. the sum of atmospheric and gauge pressure?

- A. Pressure, Absolute
- B. Pressure
- C. Hydraulics
- D. Hydrokinetics
- E. Pascal's Law
- F. None of the Above

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

- A. True
- B. False

### General Pumping Fundamentals

230. 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

231. According to the text, suction lift is when the level of water to be pumped is below the?

- A. Impeller
- B. Suction
- C. Lift water
- D. Centerline of the pump
- E. Bellows
- F. None of the Above

232. According to the text, the ability of the pump to lift water is the result of a partial vacuum created at the?

- A. Partial vacuum
- B. Suction lift
- C. Center of the pump
- D. Pressure differential
- E. Negative suction head
- F. None of the Above

233. The suction side of pipe should be one diameter smaller than the pump inlet.

- A. True
- B. False

234. The required eccentric reducer should be turned so that the top is flat and the bottom tapered.

- A. True
- B. False

### Pump Definitions

235. Which of the following definitions is a barrier that separates stages of a multi-stage pump?

- A. Gasket
- B. Keyway
- C. Bearing
- D. Inter-stage diaphragm
- E. Seal
- F. None of the Above

236. Which of the following definitions is a rectangular piece of metal that prevents the impeller from rotating on the shaft?

- A. Gasket
- B. Key
- C. Energy
- D. Bearing
- E. Seal
- F. None of the Above

237. Which of the following definitions is the area on the shaft that accepts the key?

- A. Gasket
- B. Keyway
- C. Energy
- D. Inter-stage diaphragm
- E. Kinetic energy
- F. None of the Above

238. Which of the following definitions is any substance that can be pumped such as oil, water, refrigerant, or even air?

- A. Fluid
- B. Mixed flow pump
- C. Energy
- D. Substance
- E. Flow
- F. None of the Above

239. Which of the following definitions is a mechanical device that seals the pump stuffing box?

- A. Packing
- B. Bearing
- C. Seal
- D. Mechanical seal
- E. Lantern ring
- F. None of the Above

240. Which of the following definitions is a pump that uses both axial-flow and radial-flow components in one impeller?

- A. Bellows
- B. Mixed flow pump
- C. Kinetic energy
- D. Dynamic
- E. Diaphragm pump
- F. None of the Above

### **Pumps**

241. More complicated pumps have valves check valves that open to allow \_\_\_\_\_, and close automatically to prevent reverse flow.

- A. Pistons
- B. Diaphragms
- C. Discharged fluid
- D. Passage in one direction
- E. Lift pumps
- F. None of the Above

242. There are many kinds of \_\_\_\_\_, and can be the most trouble-prone and complicated part of a pump.

- A. Rotors
- B. Force pumps
- C. Inlets
- D. Air space
- E. Valves
- F. None of the Above

243. According to the text, the force pump has \_\_\_\_\_ in the cylinder, one for supply and the other for delivery.

- A. Two check valves
- B. Diaphragms
- C. Rotors
- D. Cylinders
- E. Lift pumps
- F. None of the Above

244. Pumps are excellent examples of?

- A. Hydrostatics
- B. Quasi-static
- C. Oscillating diaphragm
- D. Multi-stage pumps
- E. Complicated part
- F. None of the Above

245. Pumps are of two general types, \_\_\_\_\_ or positive displacement pumps, and pumps depending on dynamic forces, such as centrifugal pumps.

- A. Hydrostatic
- B. Quasi-static
- C. Oscillating diaphragm
- D. Hydrostatic considerations
- E. Complicated part
- F. None of the Above

246. Positive displacement pumps have a piston (or equivalent) moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.

- A. True
- B. False

247. The supply valve opens when the cylinder \_\_\_\_\_, the delivery valve when the cylinder volume decreases.

- A. Rotor
- B. Force pump
- C. Volume decreases
- D. Air space
- E. Volume increases
- F. None of the Above

248. According to the text, the lift pump has a \_\_\_\_\_ and a valve in the piston that allows the liquid to pass around it when the volume of the cylinder is reduced.

- A. Supply valve
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Lift pumps
- F. None of the Above

249. The delivery in this case is from the upper part of the \_\_\_\_\_, which the piston does not enter.

- A. Rotor
- B. Force pump
- C. Volume decreases
- D. Air space
- E. Cylinder
- F. None of the Above

250. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston.

- A. True
- B. False

251. Which of the following terms may be moved mechanically, or by the pressure of the fluid on one side of the diaphragm?

- A. Piston
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Lift pumps
- F. None of the Above

252. Which of the following terms are typically used for water?

- A. Bellows
- B. Force pumps
- C. Volume pumps
- D. Force and lift pumps
- E. Delivery pumps
- F. None of the Above

253. The force pump has two valves in the cylinder, while the lift pump has one valve in the cylinder and one in the piston.

A. True B. False

254. Which of the following terms is determined by the atmospheric pressure, and either cylinder must be within this height of the free surface?

- A. Suction
- B. Diaphragm
- C. Discharged fluid
- D. Discharge
- E. Force
- F. None of the Above

255. The force pump can give an arbitrarily large pressure to the \_\_\_\_\_, as in the case of a diesel engine injector.

- A. Rotor
- B. Discharged fluid
- C. Volume decreases
- D. Air space
- E. Delivery
- F. None of the Above

256. Fire fighting force pumps usually have two cylinders feeding one receiver alternately.

A. True B. False

257. The air space in the receiver helps to make the?

- A. Rotor
- B. Water pressure uniform
- C. Volume decreases
- D. Air space
- E. Delivery
- F. None of the Above

258. The Roots blower has no valves, their place taken by the \_\_\_\_\_ between the rotors and the housing.

- A. Piston
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Sliding contact
- F. None of the Above

259. The Roots blower can either exhaust a receiver or provide \_\_\_\_\_ under moderate pressure, in large volumes.

- A. Air
- B. Mixed flow
- C. Dynamic
- D. Discharge tube
- E. Roots blower
- F. None of the Above

260. The Bellows is a very old device, requiring no accurate machining.

A. True B. False

261. The single valve is in one or both sides of the expandable?

- A. Cylinder
- B. Chamber
- C. Radial flow
- D. Cavity
- E. Positive Displacement Pump(s)
- F. None of the Above

262. Which of the following terms uses the valve on the valve stem of the tire or inner tube to hold pressure in the tire?

- A. Bellows pump
- B. Chamber pump
- C. Radial flow pump
- D. Bicycle pump
- E. Positive Displacement Pump
- F. None of the Above

263. Which of the following terms, which is attached to the discharge tube, has a flexible seal that seals when the cylinder is moved to compress the air, but allows air to pass when the movement is reversed?

- A. Piston
- B. Diaphragm
- C. Discharged fluid
- D. Cylinder
- E. Sliding contact
- F. None of the Above

264. According to the text, diaphragm and vane pumps act the same way by varying the volume of a chamber, and directing the flow with?

- A. Cylinder
- B. Check valves
- C. Radial flow
- D. Cavity
- E. Positive Displacement Pump(s)
- F. None of the Above

### Pump Categories

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

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Delivery force
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

266. Pump operation like with a centrifugal pump — pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called?

- A. Inward force
- B. Head
- C. Viscous drag pump
- D. Center of the impeller
- E. Incompressible fluid
- F. None of the Above

267. According to the text, pumps may be classified on the basis of the application they serve.

- A. True
- B. False

268. According to the text, all pumps may be divided into two major categories: (1) dynamic and (2)?

- A. Centrifugal
- B. Impeller
- C. Displacement
- D. Diaphragm
- E. Rotary
- F. None of the Above

### Basic Water Pump

269. In a centrifugal pump, as water drifts outward between the \_\_\_\_\_ of the pump, it must move faster and faster because its circular path is getting larger and larger.

- A. Centrifugal pump(s)
- B. Impeller blade(s)
- C. Bernoulli's equation
- D. Diaphragm pump(s)
- E. Cylindrical pump housing
- F. None of the Above

270. As the water slows down and its kinetic energy decreases, that water's pressure potential energy increases.

- A. True
- B. False

271. As the water spins, the pressure near the outer edge of the pump housing becomes much lower than near the center of the impeller.

- A. True
- B. False



**Venturi (Bernoulli's law):**

282. A venturi is a pipe that has a gradual restriction that opens up into a gradual enlargement.

- A. True            B. False

**Types of Water Pumps**

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

- A. True            B. False

284. The most common type of water pumps used for municipal and domestic water supplies are?

- A. Axial flow            D. Turbine pump(s)  
B. Submersible        E. Variable displacement pumps  
C. Rotary pump        F. None of the Above

285. Which of the following terms will produce at different rates relative to the amount of pressure or lift the pump is working against?

- A. Variable displacement pump        D. Single or multiple bowls  
B. Drive shaft                            E. Pump's lifting capacity  
C. Column pipe                            F. None of the Above

286. Impellers are rotated by the pump motor, which provides the \_\_\_\_\_ needed to overcome the pumping head.

- A. Spider bearing(s)            D. Turbine pump(s)  
B. Horsepower                          E. Desired pumping rate  
C. Impeller(s)                          F. None of the Above

287. The size and number of stages, horsepower of the motor and \_\_\_\_\_ are the key components relating to the pump's lifting capacity.

- A. Pumping head        D. Single or multiple bowls  
B. Drive shaft            E. Pump's lifting capacity  
C. Column pipe        F. None of the Above

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

- A. Axial flow            D. Turbine pump(s)  
B. Submersible        E. Centrifugal pumps  
C. Rotary pump        F. None of the Above

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

- A. Lift water            D. Single or multiple bowls  
B. Drive shaft            E. Pump's lifting capacity  
C. Column pipe        F. None of the Above

290. Vertical turbine pumps are commonly used in groundwater wells. These pumps are driven by a shaft rotated by a motor on the surface.

- A. True            B. False

291. The shaft turns the impellers within the pump housing while the?  
 A. Spider bearing(s)                      D. Water moves up the column  
 B. Horsepower turns the shaft            E. Desired pumping rate is obtained  
 C. Impeller(s)                                F. None of the Above
292. The rotating shaft in a line shaft turbine is actually housed within the column pipe that delivers the water to the surface.  
 A. True                      B. False
293. The size of the \_\_\_\_\_ are selected based on the desired pumping rate and lift requirements.  
 A. Spider bearing(s)    D. Column, impeller, and bowls  
 B. Horsepower            E. Desired pumping rate  
 C. Impeller(s)            F. None of the Above
294. According to the text, column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by?  
 A. Oil tube                      D. Single or multiple bowls  
 B. Spider bearings            E. Pump's lifting capacity  
 C. Column pipe                F. None of the Above
295. The water passing through the column pipe serves as the lubricant for the bearings.  
 A. True                      B. False
296. Which of the following terms, provide both a seal at the column pipe joints and keep the shaft aligned within the column?  
 A. Spider bearing(s)            D. Roller bearings  
 B. Keyway                        E. Lantern rings  
 C. Impeller(s)                 F. None of the Above
297. According to the text, water and oil lubricated turbine pump units can be driven by?  
 A. Gears                        D. Electric or fuel powered motors  
 B. Drive shaft                 E. Pump's lifting capacity  
 C. Column pipe                F. None of the Above
298. Often an electric motor that is connected to the \_\_\_\_\_ by a keyway and nut.  
 A. Drive shaft                 D. Sprocket  
 B. Rotor                        E. Time delay or ratchet assembly  
 C. Inboard                     F. None of the Above
299. Which of the following terms: water flowing back down the column, turning the impellers in a reverse direction?  
 A. Vapor bubbles are created            D. Volumetric positive displacement is turned off  
 B. Chamber pressure                        E. Line shaft turbine is turned off  
 C. Drive shaft is off                         F. None of the Above

300. Time delays or ratchet assemblies are often installed on these motors to either prevent the motor from turning on before \_\_\_\_\_ stops or simply not allow it to reverse at all.

- A. Reverse rotation
- B. Diaphragm
- C. Inertial cavitation
- D. Keyway and nut
- E. Time delay or ratchet assembly
- F. None of the Above