

**Registration form**

**Valve Operation and System Design CEU Training Course \$150.00  
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

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

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

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

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

Water Treatment \_\_\_\_\_ Distribution \_\_\_\_\_ Collection \_\_\_\_\_

Wastewater Treatment \_\_\_\_\_ Other \_\_\_\_\_

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

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**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.

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*You can obtain a printed version of the course 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.

**Do not solely depend on TLC's Approval list for it may be outdated.**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

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

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# Valve Operation and System Design CEU Course 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*

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

Did you receive the approval number if Applicable? \_\_\_\_\_

What is the 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 use Adobe Acrobat DC Program to complete the assignment.*

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

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

**VALVE OPERATION AND SYSTEM DESIGN  
CEU TRAINING COURSE  
CUSTOMER SERVICE RESPONSE CARD**

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

Please rate the difficulty of your course.

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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.

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Any other concerns or comments.

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

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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. Thank you...



## Valve Operation and system Design 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.**

### Common Hydraulic Terms

1. Which of the following definitions is the engineering science that pertains to liquid pressure and flow?

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

2. 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

3. Which of the following definitions is the pressure applied to a confined fluid at rest and 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

4. 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

5. 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

6. 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

7. 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

8. Which of the following definitions is the pressure in a fluid at rest?

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

9. 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

10. 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

11. 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

12. 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

13. Which of the following definitions is the pressure equal to the height times the density of the liquid?

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

14. Which of the following definitions is required to overcome the friction at the interior surface of a conductor and between fluid particles in motion?

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

15. Which of the following definitions varies with flow, size, type, and conditions of conductors and fittings, and the fluid characteristics?

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

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

- A. True
- B. False

### **Water Distribution System Design and Valves**

#### **System Elements**

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

- A. Increase water pressure
- B. Equalize
- C. Complete gridiron system
- D. Boost flow
- E. Provide a reserve pressure
- F. None of the Above

18. Arterial mains which are interconnected with smaller distribution mains form a complete gridiron system and are mains for?

- A. Increasing water pressure
- B. Tree system
- C. Complete gridiron system
- D. Distribution mains of large size
- E. Fire protection
- F. None of the Above

19. Valves control the flow of water in the distribution system by isolating areas for repair or by this device?

- A. Increase water pressure
- B. Bypasses
- C. Complete gridiron system
- D. Main line isolation
- E. Regulating system flow or pressure.
- F. None of the Above

20. According to the text, gate valves should be used in the \_\_\_\_\_ for main line isolation.

- A. Increase water pressure
- B. Distribution tree
- C. Complete gridiron system
- D. Distribution system
- E. Arterial system
- F. None of the Above

21. Water distribution mains function is to carry water from the water source or treatment works to users, these pipelines make up the?

- A. Increase water pressure
- B. Distribution tree
- C. Complete gridiron system
- D. Distribution system
- E. Arterial system
- F. None of the Above

22. Storage reservoirs are structures used to store water and \_\_\_\_\_ the supply or pressure in the distribution system.

- A. Increase water pressure
- B. Equalize
- C. Complete gridiron system
- D. Main line isolation
- E. Provide a reserve pressure
- F. None of the Above

### Butterfly Valve

23. Butterfly valves are rotary type of valves usually found on large transmission lines, and may also have an additional valve beside it known as a \_\_\_\_\_ to prevent water hammer.

- A. Regulator
- B. Bypass
- C. Complete gridiron system
- D. Main line isolation
- E. PRV
- F. None of the Above

### Water Distribution Valves

24. One purpose of installing shutoff valves in water mains at various locations within the distribution system is to allow sections of the system to be \_\_\_\_\_ or provide maintenance without significantly curtailing service over large areas.

- A. Feeders as practical
- B. Adjust the pressure
- C. Open or close the valve
- D. Curtail the service
- E. Taken out of service for repairs
- F. None of the Above

25. According to the text, at intersections of distribution mains, the number of valves required is normally one less than the number of ?

- A. Ties
- B. Depends
- C. Radiating mains
- D. Throttling purposes
- E. Standardizes
- F. None of the Above

26. All buried small and medium-sized valves should be installed in the sidewalk.

- A. True
- B. False

27. For large shutoff valves, it may be necessary to surround the valve operator or entire valve within a vault or manhole to allow ?

- A. Principally
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

### Gate Valves

28. In the distribution system, gate valves are used when a straight-line flow of fluid and for ?

- A. Principally
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

29. In the distribution system, or on a residential job, gate valves are so-named because the part that either \_\_\_\_\_ flow through the valve acts somewhat like a gate.

- A. Fully drawn up
- B. Dependability
- C. Repair or replacement
- D. Minimum flow restriction
- E. Stops or allows
- F. None of the Above

30. If the valve is wide open, the gate is \_\_\_\_\_ into the valve bonnet.  
A. Fully drawn up                      D. Minimum flow restriction  
B. Dependable                            E. Stops or allows  
C. Repair or replacement              F. None of the Above

31. Gate valves are not suitable for?  
A. Copper lines    D. Throttling purposes  
B. Dependability   E. Pressure drops  
C. PRV              F. None of the Above

32. The control of flow is easy because of the valve's design.  
A. True              B. False

### Ball Valves

33. Most ball valves require only a 180-degree turn to either completely open or close the valve.

A. True              B. False

34. According to the text, some ball valves are operated by planetary gears.

A. True              B. False

35. Ball valves should be either fully-on or fully-off, some ball valves also contain a swing check located within the ball to give the valve a check valve feature.

A. True              B. False

### Valve Exercising

36. 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

37. 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

38. Service connections are used to \_\_\_\_\_ or other plumbing systems to the distribution system mains.

A. Be isolated                            D. Limits the expansion  
B. Connect individual buildings      E. Decreases in size  
C. By laying out                         F. None of the Above

### If Excessive Torque is Needed to Work the Valve

39. One cause of a valve failing to open are variations in the temperature and/or pressure of the?

- A. High pressure side
- B. Working fluid
- C. Closing torque applied
- D. Valve sealing surfaces
- E. Length of exposure
- F. None of the Above

40. Depending on the seat and wedge material, \_\_\_\_\_ and closing torque applied, thermal binding can also occur in high temperature situations.

- A. High pressure side
- B. Working fluid
- C. Closing torque applied
- D. Valve sealing surfaces
- E. Length of exposure
- F. None of the Above

41. Over-pressurization is when a valve can \_\_\_\_\_ when high pressure enters the cavity and has no way to escape.

- A. Over-pressurization
- B. Positive pressure differential
- C. Lock in the closed position
- D. Lock in the open position
- E. Break
- F. None of the Above

42. Tuberculation corrosion is caused by chemical changes produced by?

- A. Closed position
- B. Hard water
- C. Chemical changes
- D. Electricity or electrolysis
- E. Positive pressure differential
- F. None of the Above

43. Corrosion will increase the C-Factor and the carrying capacity in a pipe.

- A. True
- B. False

### Knife Gate Valve

44. Install the knife gate valve so that the arrows on both sides of the body are in the direction of?

- A. Positive pressure differential
- B. Handwheel pointing up
- C. Connect individual buildings
- D. Direction of the service
- E. Bonnet
- F. None of the Above

### Common Rotary Valves

45. Globe valve, a rotary valve is rare to find in most distribution systems, but can be found at treatment plants.

- A. True
- B. False

46. Most Globes have compact OS & Y type, bolted bonnet, rising stems, with renewable seat rings.

- A. True
- B. False

47. According to the text, Globe valves should usually be installed with the inlet below the bonnet.

- A. True
- B. False

48. For light throttling service, the valve may be installed so that the flow enters over the bottom of the seat and goes up through it.

A. True B. False

49. The globe valve may be installed in other orientations, but any deviation from vertical is a compromise.

A. True B. False

### Valve Glossary

50. Which of the following valves are used to deliver water from a high-pressure to a low-pressure system?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Pressure regulating valve
- F. None of the Above

51. Which of the following valves is the simplest type of surge pressure relief is a pressure relief valve?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Pressure regulating valve
- F. None of the Above

52. Which of the following valves respond to pressure variations at their inlets?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Pressure regulating valve
- F. None of the Above

53. Air and Vacuum Relief Valve: Both functions are in one valve.

A. True B. False

54. Distribution system water quality can be adversely affected by improperly constructed or poorly located blowoffs of vacuum?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

55. Which of the following are often used on supply lines to elevated tanks or standpipes?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude Valve
- E. PRVs
- F. None of the Above

56. Which of the following valves close automatically when the tank is full and open when the pressure on the inlet side is less than that on the tank side of the valve?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

57. According to the text, which of the following valves are often used on the discharge side of pumps to prevent backflow?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Automatic flow-control valve
- F. None of the Above

58. To prevent water contamination, this valve in the distribution system lines must be placed in locations that cannot be flooded.

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

59. The common complaint of milky water is sometimes solved by the installation of?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

60. Which of the following valves is a linear valve used to isolate sections of the water main, to permit emergency repairs without interruption of water service to customers?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Automatic flow-control valve
- F. None of the Above

61. Which of the following valves control the high water level and prevent overflow?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

62. Which of the following valves is designed to, 1. Prevent overflows from the storage tank or reservoir?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

63. Which of the following valves' purpose is to maintain a constant water level as long as water pressure in the distribution system is adequate?

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above

64. Which of the following valves has a movable disc as large as the full-bore opening of the valve.

- A. Air relief valves
- B. Butterfly valve
- C. Air and Vacuum relief valve
- D. Altitude-Control Valve
- E. PRVs
- F. None of the Above



65. Which of the following valves maintains constant downstream pressure regardless of fluctuating demand?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Automatic flow-control valve
- F. None of the Above

66. Which of the following valves controls water pressure by restricting flows, the pressure downstream of the valve regulates the amount of flow?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Pressure regulating valve
- F. None of the Above

67. Which of the following valves are of the globe valve type of design?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Pressure regulating valve
- F. None of the Above

68. Which of the following valves control water pressure and operate by restricting flows?

- A. Pressure relief
- B. Check valve
- C. Gate valve
- D. Pressure sustaining valve
- E. Pressure regulating valve
- F. None of the Above

### Hydraulics

69. Hydraulics is a branch of engineering concerned mainly with moving liquids.

- A. True
- B. False

70. Hydraulics can be divided into two areas, \_\_\_\_\_ and hydrokinetics.

- A. Fluids
- B. Hydrostatics
- C. Hydrokinetics
- D. Mechanical properties of water
- E. Flow
- F. None of the Above

71. Hydrostatics is based on the Greek word for water, and originally covered the study of the physical behavior of water at rest and in motion.

- A. True
- B. False

72. Which of the following terms includes the behavior of all liquids, although it is primarily concerned with the motion of liquids?

- A. Fluids
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

73. Which of the following terms includes the manner in which liquids act in tanks and pipes, deals with their properties, and explores ways to take advantage of these properties?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

74. Which of the following terms includes the consideration of liquids at rest, involves problems of buoyancy and flotation?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

75. Hydraulics is applied commonly to the study of \_\_\_\_\_, other liquids, and even gases when the effects of compressibility are small.

- A. Fluids
- B. Hydrostatics
- C. Hydrokinetics
- D. Mechanical properties of water
- E. Flow
- F. None of the Above

76. Which of the following terms includes the study of liquids in motion, is concerned with such matters as friction and turbulence generated in pipes by flowing liquids?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

77. Which of the following terms is about pressures exerted by a fluid at rest?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

78. Which of the following terms is an excellent example of deductive mathematical physics, and in which the predictions agree closely with experiment?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

79. Which of the following terms is stated in that a fluid is a substance that cannot resist a shearing stress, so that pressures are normal to confining surfaces?

- A. Pressure
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydraulics
- E. Flow
- F. None of the Above

80. According to the text, hydraulics may be the physical property that varies over the largest numerical range, competing with electrical resistivity.

- A. True
- B. False

### **Atmospheric Pressure**

81. The atmosphere is the entire mass of air that surrounds the earth.

- A. True
- B. False

82. Which of the following terms is the layer called that extends upward for about 500 miles, the section of primary interest is the portion that rests on the earth's surface and extends upward for about 7 1/2 miles?

- A. Column
- B. Troposphere
- C. Sea level
- D. Mass
- E. Atmospheric pressure
- F. None of the Above

83. According the text, if a column of air 1-inch square extending all the way to the "atmosphere", this column of air would weigh approximately 2.31 pounds at sea level.

A. True B. False

84. Which of the following terms at sea level is approximately 14.7 psi?

A. Static pressure D. Bottom  
B. Pressure E. Atmospheric pressure  
C. Gauge pressure F. None of the Above

85. If you were to ascend, the atmospheric pressure increases by approximately 1.0 psi for every 2,343 feet.

A. True B. False

86. Which of the following terms if you could be below, for example- in excavations and depressions, atmospheric pressure increases?

A. Static pressure D. Sea level  
B. Pressure E. Atmospheric pressure  
C. Gauge pressure F. None of the Above

87. Pressures under water differ from those under air only because the weight of the water must be added to the?

A. Barometer D. Altitude  
B. Pressure(s) of the air E. Seal Level  
C. Height F. None of the Above

88. Which of the following terms can be measured by any of several methods, one method is the mercury column barometer?

A. Static pressure D. Sea level  
B. Pressure E. Atmospheric pressure  
C. Gauge pressure F. None of the Above

89. At sea level and temperature of 0° Celsius (C), the height of the mercury column is approximately 30 inches, or 76 centimeters. This represents a pressure of approximately 14.7 psi.

A. True B. False

90. Which of the following terms could be measured with the aneroid Barometer?

A. Static pressure D. Sea level  
B. Pressure E. Atmospheric pressure  
C. Gauge pressure F. None of the Above

91. The atmospheric pressure does not vary uniformly with?

A. Barometer D. Altitude  
B. Pressure(s) E. Equipment  
C. Weight F. None of the Above

92. Atmospheric pressure is defined as the force per unit area exerted against a surface by the \_\_\_\_\_ of the air above that surface.
- A. Barometer      D. Altitude
  - B. Pressure(s)    E. Equipment
  - C. Weight          F. None of the Above

### **Barometric Loop**

93. According to the text, the barometric loop, will provide protection against backsiphonage, is based upon the principle that a water column, at sea level pressure, will not rise above 33.9 feet. In general, barometric loops are locally fabricated and are 35 feet high.

- A. True    B. False

94. Which of the following terms could be measured on an absolute scale, pounds per square inch absolute (psia), or gauge scale, (psiag).

- A. Static pressure                      D. Sea level
- B. Pressure                                E. Atmospheric pressure
- C. Gauge pressure                      F. None of the Above

95. Absolute pressure is equal to gauge pressure plus the atmospheric pressure.

- A. True    B. False

96. The barometric loop consists of a continuous section of supply piping that abruptly rises to a height of approximately 233 feet and then returns back down to the originating level.

- A. True    B. False

97. The barometric loop is a loop in the piping system that effectively protects against backpressure.

- A. True    B. False

98. The barometric loop may not be used to protect against backsiphonage.

- A. True    B. False

99. According to the text, absolute pressure and gauge pressure?

- A. Are the same                          D. That effectively protects
- B. Referred to using pressure        E. Permanent forces tangential
- C. Are related                            F. None of the Above

100. Which of the following terms at sea level is 14.7 psia?

- A. Static pressure                      D. Sea level
- B. Pressure                                E. Atmospheric pressure
- C. Gauge pressure                      F. None of the Above

101. Which of the following terms is the total pressure?

- A. Static pressure                      D. Sea level
- B. Absolute pressure                    E. Atmospheric pressure
- C. Gauge pressure                      F. None of the Above

102. Gauge pressure is simply the pressure read on the gauge. If there is no pressure on the gauge other than atmospheric, the gauge will read zero.

- A. True B. False

103. Which of the following terms would be equal to 14.7 psi, which is the atmospheric pressure?

- A. Static pressure D. Sea level  
B. Absolute pressure E. Atmospheric pressure  
C. Gauge pressure F. None of the Above

### Pressure

104. Which of the following terms that if a certain volume of fluid were somehow made solid, the equilibrium of forces would not be disturbed?

- A. Axiom D. Displaced fluid  
B. Gravitational body force E. Gravitation  
C. Pressure F. None of the Above

105. Which of the following terms is an example of a body force that disturbs the equality of pressure in a fluid?

- A. Axiom D. Displaced fluid  
B. Gravitational body force E. Gravitation  
C. Pressure F. None of the Above

106. When the barometric equation is integrated, we find the variation of pressure with?

- A. Height or depth D. Displaced fluid  
B. Gravitational body force E. Gravitation  
C. Pressure F. None of the Above

107. Water is incompressible, while air is very compressible.

- A. True B. False

108. Both air and water are considered to be?

- A. Absolute pressure D. Volume  
B. Atmospheric pressure E. Shearing force  
C. Fluid(s) F. None of the Above

109. Which of the following terms does water possess and air does not?

- A. Absolute pressure D. Volume  
B. Atmospheric pressure E. Shearing force  
C. Fluid(s) F. None of the Above

110. A fluid is a substance that cannot exert any permanent forces tangential to a boundary and any force that it exerts on a boundary must be normal to the boundary.

- A. True B. False

111. According to the text, a force is proportional to the \_\_\_\_\_, and is called pressure.

- A. Pascal's Principle
- B. Hydrostatics
- C. Acting on the body of the fluid
- D. Permanent forces tangential
- E. Area on which it is exerted
- F. None of the Above

112. In order for the fluid to be in equilibrium, the pressure must be the same in all directions (or the element would move in the direction of least pressure), and if no other forces are?

- A. Pascal's Principle
- B. Hydrostatics
- C. Acting on the body of the fluid
- D. Permanent forces tangential
- E. Area on which it is exerted
- F. None of the Above

113. Which of the following terms does water and air have; that is, layers of them slide very easily on one another?

- A. Low viscosity
- B. Atmospheric pressure
- C. Fluid(s)
- D. Volume
- E. Shearing force
- F. None of the Above

114. Molasses and other like fluids may have high viscosity and take a long time to come to equilibrium, but they are no less?

- A. Absolute pressure
- B. Atmospheric pressure
- C. Fluid(s)
- D. Volume
- E. Shearing force
- F. None of the Above

115. The coefficient of viscosity is the ratio of this term to the velocity gradient.

- A. Absolute pressure
- B. Atmospheric pressure
- C. Fluid(s)
- D. Volume
- E. Shearing force
- F. None of the Above

116. Which of the following terms deals with permanent, time-independent states of fluids, so viscosity does not appear?

- A. Pascal's Principle
- B. Hydrostatics
- C. Acting on the body of the fluid
- D. Permanent forces tangential
- E. Area on which it is exerted
- F. None of the Above

117. In this case the pressure will be the same throughout the fluid, and the same in any direction at a point?

- A. Pascal's Principle
- B. Hydrostatics
- C. Acting on the body of the fluid
- D. Permanent forces tangential
- E. Area on which it is exerted
- F. None of the Above

**Free Surface Perpendicular to Gravity**

118. Archimedes' Principle says that the buoyant force is equal to the weight of the displaced fluid, and passes through the center of mass of?

- A. Axiom
- B. Gravitational body force
- C. Pressure
- D. Displaced fluid
- E. Gravitation
- F. None of the Above

### Standard Atmospheric Pressure

119. Which of the following terms is a practice that conveniently measures pressure differences by measuring the height of liquid columns?

- A. Barometer measurement
- B. Total vacuum
- C. Capillarity
- D. Partial vacuum measurement
- E. Manometer
- F. None of the Above

120. Which of the following terms uses a partially evacuated chamber of thin metal that expands and contracts according to the external pressure?

- A. Aneroid barometer
- B. Total vacuum
- C. Capillarity tube
- D. Partial vacuum
- E. Barometric loop
- F. None of the Above

### Vacuum

121. The term vacuum indicates that the absolute pressure is less than the atmospheric pressure and that the \_\_\_\_\_ is negative.

- A. Static pressure
- B. Pressure
- C. Gauge pressure
- D. Total vacuum
- E. Atmospheric pressure
- F. None of the Above

122. Which of the following terms would mean a pressure of 0 psia or -14.7 psig?

- A. Static pressure
- B. Pressure
- C. Gauge pressure
- D. Total vacuum
- E. Atmospheric pressure
- F. None of the Above

123. According to the text, it is impossible to produce a partial vacuum.

- A. True
- B. False

124. Which of the following terms the pressure would range from slightly less than 14.7 psia to slightly greater than 0 psia?

- A. Static pressure
- B. Pressure
- C. Gauge pressure
- D. Total vacuum
- E. Partial vacuum
- F. None of the Above

125. Backsiphonage results from \_\_\_\_\_ exerted on a liquid, forcing it toward a supply system that is under a vacuum.

- A. Static pressure
- B. Pressure
- C. Gauge pressure
- D. Atmospheric pressure
- E. Partial vacuum
- F. None of the Above

### Water Pressure

126. The weight of a cubic foot of water is 62.4 pounds per square foot. The base can be subdivided into 144-square inches with each subdivision being subjected to a pressure of 0.433 psig. This is one of our key foundation for backflow prevention.

- A. True
- B. False

127. Which of the following terms are normally stated in terms of the height of a fluid?  
 A. Friction                      D. Siphon  
 B. Weight                        E. Depth  
 C. Pressure(s)                 F. None of the Above
128. Water with a pressure head of 10 ft can provide the same \_\_\_\_\_ as an equal amount of water raised by 10 ft.  
 A. Friction                      D. Siphon  
 B. Weight                        E. Energy  
 C. Pressure(s)                 F. None of the Above
129. Water flowing in a pipe is subject to head loss because of?  
 A. Friction                      D. Siphon  
 B. Weight                        E. Energy  
 C. Pressure(s)                 F. None of the Above
130. The name is Greek for tube and is another application of pressure is the?  
 A. Epiphydro                    D. Hydrostat  
 B. Water bearer                E. Hydraulic machine  
 C. Siphon                        F. None of the Above
131. When a siphon goes below the free water levels, it is called an?  
 A. Epiphydro                    D. Hydrostat  
 B. Water bearer                E. Inverted siphon  
 C. Siphon                        F. None of the Above
132. Which of the following terms can be made by filling the tube, closing the ends, and then putting the ends under the surface on both sides?  
 A. Epiphydro                    D. Hydrostat  
 B. Water bearer                E. Inverted siphon  
 C. Siphon                        F. None of the Above

**Pressure and Force**

133. Which of the following terms is the force that pushes water through pipes?  
 A. Absolute pressure        D. Volume  
 B. Pressure                    E. Shearing force  
 C. Fluid(s)                    F. None of the Above
134. Water pressure determines the flow of water from the tap.  
 A. True   B. False
135. Which of the following terms and force are used extensively in the study of fluid power?  
 A. Absolute pressure        D. Volume  
 B. Pressure                    E. Shearing force  
 C. Fluid(s)                    F. None of the Above



136. Which of the following terms means a total push or pull. It is the push or pull exerted against the total area of a particular surface?

- A. Absolute pressure
- B. Pressure
- C. Fluid(s)
- D. Volume
- E. Force
- F. None of the Above

137. Which of the following terms means the amount of push or pull applied to each unit area of the surface?

- A. Absolute pressure
- B. Pressure
- C. Fluid(s)
- D. Volume
- E. Force
- F. None of the Above

138. Which of the following terms maybe exerted in one direction, in several directions, or in all directions?

- A. Absolute pressure
- B. Pressure
- C. Fluid(s)
- D. Volume
- E. Force
- F. None of the Above

### **Computing Force, Pressure, and Area**

139. A formula is used in computing force, volume, and area in fluid power systems. In this formula, P refers to pressure, F indicates volume, and A represents area.

- A. True
- B. False

### **Development of Hydraulics**

140. Which of the following terms to be made effective for practical applications, it was necessary to have a piston that "fit exactly?"

- A. Pascal's law
- B. Evangelista Torricelli
- C. Blaise Pascal
- D. Aristotle' law
- E. Archimedes' law
- F. None of the Above

141. According to the text, valves, pumps, actuating cylinders, and motors have been developed and refined to make hydraulics one of the leading methods of transmitting power.

- A. True
- B. False

142. One characteristic of a liquid is the tendency to keep its free surface level.

- A. True
- B. False

143. Liquids will flow in the direction that will tend to make the surface level, if the surface is not level.

- A. True
- B. False

144. Daniel Bernoulli conducted experiments to study the elements of force in the discharge of water through small openings in the sides of tanks and through short pipes.

- A. True
- B. False

145. During the same period, Blaise Pascal, a French scientist, discovered the fundamental law for the science of?

- A. Pressure      D. Force
- B. Experiments    E. Physics
- C. Hydraulics    F. None of the Above

146. Which of the following terms states that increase in pressure on the surface of a confined fluid is transmitted undiminished throughout the confining vessel or system?

- A. Pascal's law              D. Aristotle' law
- B. Evangelista Torricelli    E. Archimedes' law
- C. Blaise Pascal              F. None of the Above

147. The mercury column was held up by the horror vacui pressure as Aristotle had supposed.

- A. True    B. False

148. Which of the following scientists had a barometer carried up the 1465 m high Puy de Dôme, an extinct volcano in the Auvergne just west of his home of Clermont-Ferrand in 1648 by Périer, his brother-in-law?

- A. Aristotle                      D. Blaise Pascal
- B. Otto von Guericke            E. Archimedes'
- C. Evangelista Torricelli        F. None of the Above

149. Which of the following scientists made the first vacuum pump, which he used in vivid demonstrations of the pressure of the atmosphere?

- A. Aristotle                      D. Blaise Pascal
- B. Otto von Guericke            E. Archimedes'
- C. Evangelista Torricelli        F. None of the Above

150. Air, which is by no means incompressible. As we rise in the atmosphere and the pressure decreases, the air also expands.

- A. True    B. False

151. Which of the following terms is by no means isothermal close to the ground?

- A. Stratosphere    D. Atmospheric pressure
- B. Tropopause    E. Sea level
- C. Atmosphere    F. None of the Above

### **Meteorology**

152. Which of the following terms is of great importance in meteorology, since it determines the winds?

- A. Stratosphere    D. Atmospheric pressure
- B. Tropopause    E. Sea level
- C. Atmosphere    F. None of the Above

153. Certain typical weather patterns are associated with relatively high and relatively low \_\_\_\_\_, and how they vary with time.

- A. Stratosphere D. Pressures
- B. Tropopause E. Sea level
- C. Atmosphere F. None of the Above

**Pascal's Law**

154. Pascal discovered that pressure in a fluid acts equally in some directions.

- A. True B. False

155. According to the text, pressure acts at right angles to the containing surfaces.

- A. True B. False

156. If a pressure gauge, with an exposed face, is placed beneath the surface of a liquid at a specific depth and pointed in different directions, the pressure will read the same.

- A. True B. False

157. Pressure in a \_\_\_\_\_ of direction.

- A. Modern hydraulics D. Weight of a liquid
- B. Liquid at a specific depth E. Height of a liquid
- C. Liquid is independent F. None of the Above

158. Pressure due to the \_\_\_\_\_, at any level, depends on the depth of the fluid from the surface.

- A. Modern hydraulics D. Weight of a liquid
- B. Liquid at a specific depth E. Height of a liquid
- C. Liquid is independent F. None of the Above

159. If the exposed face of pressure gauges is moved closer to the surface of the liquid, the indicated?

- A. Depth is doubled D. Column is tripled
- B. Pressure will be less E. Is equal
- C. Pressure of a liquid F. None of the Above

160. The indicated pressure is doubled, when the?

- A. Depth is doubled D. Column is tripled
- B. Pressure will be less E. Is equal
- C. Pressure of a liquid F. None of the Above

161. The pressure at any depth in this missing term of the column of liquid at that depth divided by the cross-sectional area of the column at that depth.

- A. Depth is doubled D. Liquid is equal to the weight
- B. Pressure will be less E. Is equal
- C. Pressure of a liquid F. None of the Above

162. Which of the following terms produces the pressure is referred to as the fluid head of the liquid?

- A. Depth is doubled
- B. Pressure will be less
- C. Pressure of a liquid
- D. Volume of a liquid
- E. Is equal
- F. None of the Above

163. Which of the following terms is due to its fluid head is also dependent on the density of the liquid?

- A. Depth is doubled
- B. Pressure will be less
- C. Pressure of a liquid
- D. Volume of a liquid
- E. Is equal
- F. None of the Above

### Static Pressure

164. Static pressure exists in addition to gravity and may be present at the same time.

- A. True
- B. False

165. Pascal's law states that a pressure set up in a fluid acts equally in all directions and at right angles to the containing surfaces.

- A. True
- B. False

166. Pascal's law covers the situation only for fluids at rest or practically at rest. It is true only for the factors making up this term.

- A. Pressure drop
- B. Velocity of flow
- C. Volume of a liquid
- D. Speed
- E. Static head
- F. None of the Above

167. When velocity becomes a factor it must have a direction, the force related to the velocity must also have a direction, so that Pascal's law alone does not apply to the dynamic factors of?

- A. Pressure drop
- B. Velocity of flow
- C. Volume of a liquid
- D. Fluid power
- E. Static head
- F. None of the Above

168. The dynamic factors of inertia and friction are related to the static factors. Velocity head and \_\_\_\_\_ are obtained at the expense of static head.

- A. Pressure drop
- B. Friction head
- C. Volume of a liquid
- D. Fluid power
- E. Static head
- F. None of the Above

169. Which of the following terms can be produced by pressure or head when dealing with fluids?

- A. Pressure drop
- B. Velocity of flow
- C. Force
- D. Fluid power
- E. Static head
- F. None of the Above

### **Volume and Velocity of Flow**

170. Which of the following flow terms is passing a point in a given time is known as its volume of flow or flow rate?

- A. Pressure drop
- B. Friction head
- C. Volume of a liquid
- D. Velocity of flow
- E. Volume of flow
- F. None of the Above

171. Which of the following flow terms is usually expressed in gallons per minute (gpm) and is associated with relative pressures of the liquid, such as 5 gpm at 40 psi?

- A. Pressure drop
- B. Friction head
- C. Volume of a liquid
- D. Velocity of flow
- E. Volume of flow
- F. None of the Above

172. Which of the following flow terms is defined as the average speed at which the fluid moves past a given point. It is usually expressed in feet per second or feet per minute?

- A. Pressure drop
- B. Friction head
- C. Volume of a liquid
- D. Velocity of flow
- E. Volume of flow
- F. None of the Above

173. Which of the following flow terms is an important consideration in sizing the hydraulic lines?

- A. Pressure drop
- B. Friction head
- C. Volume of a liquid
- D. Velocity of flow
- E. Volume of flow
- F. None of the Above

174. Volume and friction head are often considered together, that is, with volume of input unchanged—the velocity of flow increases as the cross section or size of the pipe decreases.

- A. True
- B. False

### **Bernoulli's Principle**

175. Bernoulli's principle thus says that a rise (or fall) in pressure in a flowing fluid must always be accompanied by a decrease (or increase) in the speed, and conversely, if an increase (decrease) in, the speed of the fluid results in a decrease (or increase) in the pressure.

- A. True
- B. False

176. Bernoulli's principle is responsible for the fact that a shower curtain gets "sucked inwards" when the water is first turned on. What happens is that the increased water/air velocity inside the curtain (relative to the still air on the other side) causes a pressure drop.

- A. True
- B. False

177. Which of the following terms explains the difference between the outside and inside, causes a net force on the shower curtain which sucks it inward?

- A. Pressure
- B. Friction head
- C. Volume of a liquid
- D. Velocity of flow
- E. Volume of flow
- F. None of the Above

178. Squeezing the bulb over the fluid creates a low \_\_\_\_\_ area due to the higher speed of the air, which subsequently draws the fluid up.

- A. Pressure
- B. Friction head
- C. Volume of a liquid
- D. Velocity of flow
- E. Volume of flow
- F. None of the Above

179. Which of the following terms explains why windows tend to explode, rather than implode in hurricanes: the very high speed of the air just outside the window causes the pressure just outside to be much less than the pressure inside, where the air is still.

- A. Venturi effect
- B. Bernoulli's principle
- C. Velocity changes
- D. Conservation of energy
- E. Friction head
- F. None of the Above

180. Another example of \_\_\_\_\_ at work is in the lift of aircraft wings and the motion of "curve balls" in baseball. In both cases, the design is such as to create a speed differential of the flowing air past the object on the top and the bottom.

- A. Venturi
- B. Bernoulli's principle
- C. Velocity changes
- D. Conservation of energy
- F. None of the Above

### **Understanding the Venturi**

181. It is not easy to understand the reason low pressure occurs in the small diameter area of the venturi.

- A. True
- B. False

182. In the Venturi, the velocity is slower in the small portion of the tube.

- A. True
- B. False

183. In the Venturi, if velocity increases the pressure energy must decrease.

- A. True
- B. False

### **Backflow Introduction**

184. Which of the following rules are required to be at least as stringent as the federal regulations as developed and enforced by the E.P.A.?

- A. Enforcement responsibility
- B. Federal laws
- C. State program regulations
- D. Cross-Connection Control
- E. Local level laws
- F. None of the Above

185. Which of the following definition terms is "the link or channel connecting a source of pollution with a potable water supply?"

- A. Direct piping
- B. Backflow
- C. Direct connection
- D. Cross-Connection
- E. Air break
- F. None of the Above

186. Which of the following definition terms, also referred to as Cross-Connection Control, addresses a serious health issue?

- A. Direct piping
- B. Backflow prevention
- C. Direct connection
- D. Cross-Connection
- E. Water purveyor rules
- F. None of the Above

187. Cross-Connection control was addressed by passage of the "Federal Safe Drinking Water Act" as developed by the Environmental Protection Agency (E.P.A.).

- A. True
- B. False

188. The SDWA tasked each state with primary enforcement responsibility for a program to assure access to safe drinking water by all citizens.

- A. True
- B. False

189. The first level of the law is protection of the \_\_\_\_\_ of persons subject to such risks involving service to a single customer.

- A. Internal or external piping
- B. General public and the second is protection
- C. Residential environment the pollutant source
- D. Certainly not usually intentional
- E. Certainly intentional
- F. None of the Above

190. Sources of pollution that may result in a danger to health are not always obvious and such cross-connections are?

- A. Internal or external piping
- B. Public and the second is protection
- C. Residential environment the pollutant source
- D. Certainly not usually intentional
- E. Certainly intentional
- F. None of the Above

191. Within a business environment, the pollutant source may involve the unintentional cross-connection of this condition with chemical processes or a heating boiler.

- A. Direct piping
- B. Backflow
- C. Direct connection
- D. Internal or external piping
- E. Air break
- F. None of the Above

192. Which of the following may be an improper cross-connection with a landscape sprinkler system or reserve tank fire protection system?

- A. Internal or external piping
- B. Public and the second is protection
- C. Residential environment the pollutant source
- D. Certainly not usually intentional
- E. Indirect connection
- F. None of the Above

193. The following could be a cause of a cross-connection: A Situation as simple as leaving a garden hose nozzle submerged in a bucket of liquid or attached to a chemical sprayer.

- A. True B. False

194. As far as a cross-connection, another potential hazard source within any environment may be a cross-connection of piping?

- A. With an air gap D. Involving a water well located on the property.  
B. Backwater E. Air break  
C. Without a direct connection F. None of the Above

195. The proper control of cross-connections is possible but?

- A. Only through knowledge and vigilance  
B. The key is public safety and the second is protection  
C. Residential environment is always the pollutant source  
D. Certainly not usually intentional  
E. None of the Above

196. According to the text, public education is not essential, for many that are educated in piping and plumbing installations are able to recognize cross-connection dangers.

- A. True B. False

**What is backflow? Reverse flow condition**

197. Backflow is the undesirable reversal of flow of nonpotable 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

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

199. Which of the following terms is a type or form of backflow caused by a downstream pressure that is greater than the upstream or supply pressure in 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

200. 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



201. Which of the following terms can have two forms-backpressure and backsiphonage?  
 A. Backflow                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
202. 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
203. 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
204. 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 nonpotable water or other substances?  
 A. Backflow                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
205. Which of the following terms is 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                      D. Cross-connection  
 B. Backpressure                E. Indirect connection  
 C. Backsiphonage              F. None of the Above
206. Which of the following terms can occur whenever the amount of water being used exceeds the amount of water being supplied, such as during water line flushing, firefighting, or breaks in water mains?  
 A. Backflow                      D. Cross-connection  
 B. Backpressure                E. Reductions  
 C. Backsiphonage              F. None of the Above
207. Which of the following terms is the means or mechanism to prevent backflow?  
 A. High hazard installations    D. Backflow  
 B. Air gap                        E. Device or method  
 C. Backflow preventer         F. None of the Above
208. According to the text, basic means of preventing backflow is an \_\_\_\_\_, which either eliminates a cross-connection or provides a barrier to backflow.  
 A. High hazard installations    D. Backflow  
 B. Air gap                        E. Device or method  
 C. Backflow preventer         F. None of the Above

### Types of Backflow Prevention Methods and Assemblies

209. 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

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

- A. True
- B. False

211. 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

212. 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

213. 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

214. 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

215. According to the text, air gap separations must be vertically orientated a distance of at least twice the inside diameter of the supply, but never less than?

- A. 1 inch
- B. 2 inches
- C. 3 inches
- D. Backflow
- E. Depends
- F. None of the Above

216. An obstruction around or near an \_\_\_\_\_ may restrict the flow of air into the outlet pipe and nullify the effectiveness of the air gap to prevent backsiphonage.

- A. High hazard installations
- B. Backflow preventer
- C. Barrier to backflow
- D. Air gap
- E. Air break
- F. None of the Above

217. An air gap is acceptable for \_\_\_\_\_ and is theoretically the most effective protection.

- A. High hazard installations
- B. Backflow preventer
- C. Barrier to backflow
- D. Low polluttional hazards
- E. High polluttional concerns
- F. None of the Above

### **New EPA Rules for Distribution**

#### **Reduction of Lead in Drinking Water Act**

218. The Reduction of Lead in Drinking Water Act means municipalities, water districts and developers who work with and pay for water infrastructure need to be preparing.

- A. True
- B. False

219. Lead, a metal found in natural deposits, is commonly used in household plumbing materials and water service lines.

- A. True
- B. False

220. Lead in drinking water can also cause a variety of adverse health effects. In babies and children, exposure in drinking water above the action level can result in delays in physical and mental development, along with slight deficits in attention span and learning abilities. In adults, it can cause increases in blood pressure.

- A. True
- B. False

221. The most common problem is with brass or chrome-plated brass faucets and fixtures is that these devices leach significant amounts of lead into the water, especially cold water.

- A. True
- B. False

222. Homes built before 1999 are more likely to have lead pipes, fixtures and solder.

- A. True
- B. False

223. New homes are also at risk: even legally “lead-free” plumbing may contain up to 8 percent lead.

- A. True
- B. False

224. Reduction of Lead in Drinking Water Act is to amend the Safe Drinking Water Act regarding the use and introduction into commerce of lead pipes, plumbing fittings or fixtures, solder and flux.

- A. True
- B. False

225. The lead reduction law was established with a prospective effective date of January 4, 2014, which provided a three-year timeframe for affected parties to transition to the new requirements.

- A. True
- B. False

#### **Pervasive Environmental Contaminant**

226. Lead can be ingested from various sources, including lead paint and house dust contaminated by lead paint, as well as soil, drinking water, and food.

- A. True
- B. False

227. Because lead accumulates in the body, all sources of lead should be controlled or eliminated to prevent childhood lead poisoning.

A. True B. False

228. Beginning in the 1970s, lead concentrations in air, tap water, food, dust, and soil began to be reduced, resulting in significantly reduced blood lead levels in children throughout the United States.

A. True B. False

229. Homes built before the 1978 homes might contain lead paint hazards, as well as drinking water service lines made from lead, or plumbing materials that contain lead.

A. True B. False

230. Which of the following terms control reduces the leaching of lead plumbing components or solder into drinking water?

A. Lead concentrations D. Water infrastructure  
B. Adequate corrosion E. Safe Drinking Water Act (SDWA)  
C. Lead enforcement F. None of the Above

### Composite Meters

231. Composite meters are one example of a \_\_\_\_\_ alternative that is not susceptible to no-lead regulations.

A. Lead free D. Zero lead  
B. New lead-free law E. Lead-free alternative material  
C. New low-lead brass F. None of the Above

232. Composite meters do not depend on metal pricing fluctuations and have zero lead as opposed to low lead or even \_\_\_\_\_ meters.

A. Bronze D. "Friction feeling"  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

233. Which of the following terms does this type of meter boast longevity and resistance to corrosion from aggressive water?

A. Bronze D. Composite  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

234. Composite meters are constructed using a blend of plastic and?

A. Bronze D. "Friction feeling"  
B. "Lead-free" E. Fiberglass  
C. Zero lead F. None of the Above

235. Which of the following terms have been found to eliminate the "friction feeling" typically experienced with metal threads and metal couplings, facilitating easier installation?

A. Bronze D. Composite threads  
B. "Lead-free" E. A blend of plastic and fiberglass  
C. Zero lead F. None of the Above

236. With comprehensive testing, composite meters have demonstrated a burst pressure that is significantly greater than?

- A. Bronze
- B. "Lead-free"
- C. Zero lead
- D. Composite
- E. A blend of plastic and fiberglass
- F. None of the Above

237. Composite technology today allows for better, more environmentally friendly composite products that will last up to 10 years in residential applications.

- A. True
- B. False

238. Which of the following term or zero lead products on the market and it is critical that utilities consider all of their options when selecting a new fleet of meters?

- A. Bronze
- B. Lead-free
- C. Zero lead
- D. Friction
- E. Plastic and fiberglass
- F. None of the Above

239. Everyone deserves access to safe, clean water.

- A. True
- B. False

240. According to the text, it is essential that manufacturers deliver products that meet the highest standards for safety, quality, reliability and accuracy to ensure availability to, and conservation of?

- A. Frequency of sampling
- B. Their personal health
- C. Water system customers
- D. An adequate chlorine residual
- E. This most precious resource
- F. None of the Above

241. To ensure that drinking water supplied by all public water supply systems as defined by the EPA meet Federal and State requirements, water system operators are required to collect samples regularly and?

- A. Frequency of sampling
- B. Their personal health
- C. Have the water tested
- D. An adequate chlorine residual
- E. Byproduct chemicals
- F. None of the Above

242. The regulations specify maximum sampling frequencies, sampling locations, testing procedures, methods of keeping records, and frequency of reporting to the State.

- A. True
- B. False

243. The regulations also mandate special reporting procedures to be followed if a contaminant exceeds \_\_\_\_\_.

- A. An MCL
- B. Chemical analyses
- C. Turbidity
- D. Continuous chlorine residual
- E. No concern for byproducts
- F. None of the Above

244. According to the text, about half the distribution systems must provide periodic monitoring for microbiological contaminants and some chemical contaminants.

- A. True
- B. False

245. The frequency of sampling and the chemicals that must be tested for depend on the physical size of the water system, \_\_\_\_\_, and the history of analyses.

- A. Frequency of sampling
- B. The water source
- C. Water system customers
- D. An adequate chlorine residual
- E. Byproduct chemicals
- F. None of the Above

### General Disinfection Requirements

246. According to the text, disinfection is absolutely required for all water systems using surface water sources.

- A. True
- B. False

247. As the water enters the distribution system, it must carry a \_\_\_\_\_ that will be retained throughout the distribution system.

- A. Disinfectant like UV
- B. Chemical analyses
- C. Ozone
- D. Continuous chlorine residual
- E. Byproduct of chlorine
- F. None of the Above

248. Water samples from points on the distribution system must be analyzed periodically to make sure \_\_\_\_\_ is being maintained.

- A. Frequency of sampling
- B. Their personal health
- C. Water system customers
- D. An adequate chlorine residual
- E. Byproduct chemicals
- F. None of the Above

249. The use of chlorine has almost completely eliminated occurrences of waterborne diseases in the United States.

- A. True
- B. False

250. The disinfection byproducts are formed when chlorine reacts with naturally occurring substances in raw water such as decaying vegetation containing?

- A. An MCL
- B. Chemical analyses
- C. Turbidity
- D. Humic and fulvic acids
- E. No concern for byproducts
- F. None of the Above

251. Which of the following terms was identified was trihalomethane, a group of organic chemicals that are known carcinogens to some animals, so they are assumed also to be carcinogenic to humans?

- A. MCLs
- B. HAAA5s
- C. Chloramines
- D. Chlorine residual
- E. Chlorine byproduct chemicals
- F. None of the Above

252. Which of the following terms have been identified that may be harmful, and may cause some adverse health reactions?

- A. Other byproducts of disinfection
- B. Chemical analyses
- C. Turbidity
- D. Continuous chlorine residual
- E. Chloramines
- F. None of the Above

### **Consumer Confidence Reports**

253. One of the very significant provisions of the 1996 SDWA amendments is the addition of the consumer confidence report (CCR) requirement.

A. True B. False

254. Information on the source water and \_\_\_\_\_ must be furnished to the satellite system by the system selling the water.

- A. An MCL                      D. Continuous chlorine residual  
B. Chemical analyses        E. No concern for byproducts  
C. Turbidity                    F. None of the Above

255. The reports must be prepared yearly by every community water supply system.

A. True B. False

256. Water systems serving more than 10,000 people must mail the report to customers.

A. True B. False

257. The purpose of the CCR is to provide all water customers with basic facts regarding their drinking water so that individuals can make decisions about decisions based on their personal health.

A. True B. False

258. According to the text, water system operators should keep in mind that CCRs provide an opportunity to educate consumers about the?

- A. MCL                              D. Continuous chlorine residual  
B. Chemical analyses            E. Sources and quality of their drinking water  
C. Concern for byproducts      F. None of the Above

### **Distribution System Water Quality Problems**

#### **Turbidity**

259. Turbidity is caused by particles suspended in water, these particles scatter or reflect light rays, making the water appear cloudy.

A. True B. False

260. Turbidity in water is significant from a public health standpoint because \_\_\_\_\_ could shelter microorganisms from the disinfectant and allow them to still be viable when they reach the customer.

- A. Germs                          D. Turbidity  
B. Hardness                      E. Suspended particles  
C. Chlorine                        F. None of the Above

261. EPA regulations direct that, for most water systems, the turbidity of water entering the distribution system must be equal or less than 0.5 ntu in at least 95 percent of the measurements taken each month.

A. True B. False

262. At no time may the turbidity exceed 5 ntu.

A. True B. False

263. Increases in turbidity may be caused by changes in velocity or inadequate flushing following main replacement.

A. True B. False

### Hardness

264. Water hardness usually comes from water contacting rock formations, such as water from wells in?

- A. Turbidity D. Concentration of calcium and magnesium  
B. Hard and soft water E. Limestone formations  
C. Ferrous iron F. None of the Above

265. Most surface water is of?

- A. Hard hardness D. Hard and soft water  
B. Hardness E. Soft hardness  
C. Medium hardness F. None of the Above

266. Water with 300 mg/L of hardness usually is considered soft.

A. True B. False

267. Hard water usually is quite corrosive, and may have to be treated to reduce the corrosivity.

A. True B. False

### Iron

268. Ferrous iron ( $Fe_2$ ) is in a \_\_\_\_\_, and water containing ferrous iron is colorless.

- A. Corrosivity D. Turbidity  
B. Hardness E. Rust-colored  
C. Dissolved state F. None of the Above

269. Ferric iron ( $Fe_3$ ) has been oxidized, and water containing it is?

- A. Corrosivity D. Turbidity  
B. Hardness E. Rust-colored  
C. Medium hardness F. None of the Above

270. Gallionella can cause \_\_\_\_\_, tastes and odors, clogged pipes, and pump failure.

- A. Bacteriological safety D. Entry of contaminants  
B. System failure E. Red water  
C. Bacteria F. None of the Above

271. Water samples show increased iron concentrations between the point where water enters the distribution system and the consumer's tap, either corrosion, Iron bacteria, or both are probably taking place.

A. True B. False

272. If the problem is caused by system pressure, flushing mains, shock chlorination, and carrying increased residual chlorine are alternatives to consider.

A. True B. False



## Manganese

273. The NSDWR recommend a concentration not to exceed 0.05 mg/L to avoid?

- A. Corrosion
- B. Customer complaints
- C. Pressure loss
- D. Harmful effects on humans
- E. Water system contamination
- F. None of the Above

## Water Quality Safeguards

274. Which of the following terms are recommended is absolutely necessary to prevent back siphonage and the entry of contaminants?

- A. Bacteriological safety
- B. Static pressure
- C. Chlorine
- D. Monitoring
- E. Continuous positive pressure
- F. None of the Above

275. Either water use must be restricted or the water system must be upgraded to be capable of supplying more water, if water demands are so great during peak demand periods that pressure declines in parts of the systems.

- A. True
- B. False

276. Which of the following terms also may be reduced during a main break because of the large amount of escaping water?

- A. Bacteriological safety
- B. System pressure
- C. Backpressure
- D. Cross connection
- E. Backflow
- F. None of the Above

## Types of Joints

277. Caulked joints for which of the following terms shall be firmly packed with oakum or hemp and filled with molten lead?

- A. Bore and all chips
- B. Brass or copper
- C. Lead ring
- D. Oakum or hemp and filled with molten lead
- E. Cast iron hub-and-spigot pipe
- F. None of the Above

278. Paint, varnish, or other coatings shall not be permitted on the jointing material until after a plumbing inspector has been given the opportunity to test and approve or disapprove the?

- A. Joint
- B. Caulking ferrule
- C. Wiped joints
- D. Properly soldered together
- E. Jointing material
- F. None of the Above

## Threaded/Screwed Joints.

279. All burrs shall be removed; pipe ends shall be reamed or filed to size of the which of the following terms shall be removed?

- A. Bore and all chips
- B. Brass or copper
- C. Lead ring
- D. Oakum or hemp and filled with molten lead
- E. Cleaned bright
- F. None of the Above

280. Which of the following terms shall have exposed surface on each side of the joint at least  $\frac{3}{4}$ " and at least as thick as the material being joined?

- A. A proper flaring tool
- B. Caulking ferrule
- C. Wiped joints
- D. Properly soldered together
- E. Jointing material
- F. None of the Above

281. Wall or floor flange lead-wiped joints shall be made by using a lead ring or which of the following terms placed behind the joints at the wall or floor?

- A. Bore and all chips
- B. Brass or copper
- C. Lead ring
- D. Oakum or hemp and filled with molten lead
- E. Flange
- F. None of the Above

282. Which of the following terms between lead pipe and cast iron, steel or wrought iron shall be made by means of a caulking ferrule, soldering nipple, or bushing?

- A. Joints
- B. Caulking ferrule
- C. Wiped joints
- D. Properly soldered together
- E. Jointing material
- F. None of the Above

### **Soldered Joints.**

283. The joints shall be which of the following terms and made with approved lead free solder?

- A. Bore and all chips
- B. Brass or copper
- C. Lead ring
- D. Properly fluxed
- E. Cleaned bright
- F. None of the Above

284. Joints in copper water tubing shall be made with approved cast bronze or wrought copper pressure fittings?

- A. A proper flaring tool
- B. Caulking ferrule
- C. Wiped joints
- D. Properly soldered together
- E. Jointing material
- F. None of the Above

285. All solders or flux containing more than 0.2% lead shall bear a warning label which states that the solder or?

- A. Bore and all chips
- B. Brass or copper
- C. Lead ring
- D. Molten lead
- E. Flux
- F. None of the Above

### **Flared Joints.**

286. Which of the following terms for plastic pipe and tubing and soft copper water tubing shall be made with approved fittings?

- A. Approved fitting(s)
- B. Flared joints
- C. Collar
- D. Are prohibited
- E. Are approved
- F. None of the Above

### **Plastic Pipe Joints**

287. Every joint in plastic piping shall be made with approved fittings by either solvent welded or fusion welded connections, compression fittings, approved insert fittings, metal clamps and screws of corrosion resistant material, or?

- A. Adaptor fittings
- B. Compression fittings
- C. Solvent welded
- D. Threaded joints
- E. Thermal welded joints and fittings
- F. None of the Above

**Joints and Fittings in Plastic Pipe.**

288. Which of the following terms and joints shall be in accordance with the manufacturer's recommendations?

- A. Clamps
- B. Potable water piping fittings
- C. Slip joints
- D. Ground joint connections
- E. Threaded or flanged joints
- F. None of the Above

289. Polyethylene (PE) pipe shall be installed only with compression fittings, insert and clamp type fittings or?

- A. Adaptor fittings
- B. Compression fittings
- C. Solvent welded
- D. Threaded joints
- E. Thermal welded joints and fittings
- F. None of the Above

290. Which of the following terms shall be of corrosion resistant material, the inside diameter of any insert fitting shall not be less than the minimum allowable size for water service/distribution piping?

- A. Clamps
- B. Fittings and joints
- C. Slip joints
- D. Ground joint connections
- E. Threaded or flanged joints
- F. None of the Above

291. Polyvinyl chloride (PVC) pipe shall be installed with which of the following terms joints only?

- A. Adaptor fittings
- B. Compression fittings
- C. Solvent welded
- D. Solvent welded or flanged
- E. Thermal welded joints and fittings
- F. None of the Above

292. The primer and solvent cement used shall be in accordance with the manufacturer's recommendation for?

- A. Polyvinyl chloride piping
- B. Fittings and joints
- C. Slip joints
- D. Ground joint connections
- E. Threaded or flanged joints
- F. None of the Above

293. Polybutylene (PB) pipe shall be installed only with insert and clamp type fittings, compression type, flanged type, or?

- A. Adaptor fittings
- B. Compression fittings
- C. Solvent welded
- D. Threaded joints
- E. Thermal welded joints and fittings
- F. None of the Above

**Plastic Pipe.**

294. Joints between plastic pipe and which of the following terms shall be made only with an appropriate type adaptor?

- A. Proper adaptor fittings
- B. Flared joints
- C. Appropriate type adaptor
- D. Neoprene gasket and stainless steel bands
- E. Non-plastic material
- F. None of the Above

**Plastic-Commingling.**

295. There shall be no commingling of which of the following terms within the same plumbing system except through the use of proper adaptors?

- A. Proper adaptors
- B. Wiped joints
- C. Unions
- D. Plastic materials
- E. Stainless steel bands
- F. None of the Above

296. Plastic pipe shall not be installed in which of the following terms or chase that contains uninsulated hot water?

- A. Proper adaptor fittings
- B. Flared joints
- C. Appropriate type adaptor
- D. Any tunnel
- E. Plastic pipe
- F. None of the Above

**Unions**

297. Which of the following terms may be used in the drainage and venting system when accessibly located above ground?

- A. Proper adaptors
- B. Wiped joints
- C. Unions
- D. Stop box connections
- E. Stainless steel bands
- F. None of the Above

298. Which of the following terms shall be installed in a water supply system within 5 feet of regulating equipment, water heaters, water conditioning tanks, water-conditioning equipment, pumps?

- A. Proper adaptors
- B. Wiped joints
- C. Unions
- D. Stop box connections
- E. Stainless steel bands
- F. None of the Above

**Water Supply System.**

299. Unions in the water supply system shall be metal to metal with ground seats, except that plastic to metal unions may utilize durable, non-toxic, impervious?

- A. Proper adaptors
- B. Wiped joints
- C. Gaskets
- D. Metal to metal with ground seats
- E. Stainless steel bands
- F. None of the Above

300. Unions between copper pipe/tubing and dissimilar metals shall either be made with a brass converter fitting or be?

- A. Proper adaptors
- B. Wiped joints
- C. A dielectric type union
- D. Metal to metal with ground seats
- E. Stainless steel bands
- F. None of the Above