

Registration form

CROSS-CONNECTION ID CEU TRAINING COURSE \$100.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00

Start Date: _____ **Finish Date:** _____
You will have 90 days from this date in order to complete this course

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/PDH's.

Water Treatment _____ Distribution _____ Collection _____ BPAT _____

Well Drillers _____ Pump Installer _____ CSI _____ WTS _____

Other _____

Your certificate will be mailed to you in about two weeks unless you pay for the rush service.

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You can obtain a printed version of the course manual from TLC for an additional \$49.95 plus shipping charges.

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.

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.

Texas TCEQ STUDENTS ONLY

All TCEQ Students will need to sign this and date this form as well. TCEQ students will also be given special assistance if you fail the examination. You will also have access to failed or wrong questions and/or the area or topic of the assignment to complete your learning experience.

Attention Texas TCEQ Operators, Irrigators, CSI and Backflow Testers...

NOTE: Any course cannot be taken for same credit in the same renewal period. Please call TCEQ and make sure that these courses are still accepted for credit before starting. Do not retake this course for credit in the same renewal period. TCEQ rules and decisions change frequently. (512) 239-4482 or (512) 239-0178.

Signature _____

Cross-Connection CEU Course Answer Key

Name _____ Telephone # _____

Please select one answer. You can Bold, Circle, Underline or X your answer.

- | | | |
|---------------|---------------|----------------|
| 1. A B C D E | 42. A B C D E | 83. A B C D E |
| 2. A B C D E | 43. A B C D E | 84. A B C D E |
| 3. A B C D E | 44. A B C D E | 85. A B C D E |
| 4. A B C D E | 45. A B C D E | 86. A B C D E |
| 5. A B C D E | 46. A B C D E | 87. A B C D E |
| 6. A B C D E | 47. A B C D E | 88. A B C D E |
| 7. A B C D E | 48. A B C D E | 89. A B C D E |
| 8. A B C D E | 49. A B C D E | 90. A B C D E |
| 9. A B C D E | 50. A B C D E | 91. A B C D E |
| 10. A B C D E | 51. A B C D E | 92. A B C D E |
| 11. A B C D E | 52. A B C D E | 93. A B C D E |
| 12. A B C D E | 53. A B C D E | 94. A B C D E |
| 13. A B C D E | 54. A B C D E | 95. A B C D E |
| 14. A B C D E | 55. A B C D E | 96. A B C D E |
| 15. A B C D E | 56. A B C D E | 97. A B C D E |
| 16. A B C D E | 57. A B C D E | 98. A B C D E |
| 17. A B C D E | 58. A B C D E | 99. A B C D E |
| 18. A B C D E | 59. A B C D E | 100. A B C D E |
| 19. A B C D E | 60. A B C D E | 101. A B C D E |
| 20. A B C D E | 61. A B C D E | 102. A B C D E |
| 21. A B C D E | 62. A B C D E | 103. A B C D E |
| 22. A B C D E | 63. A B C D E | 104. A B C D E |
| 23. A B C D E | 64. A B C D E | 105. A B C D E |
| 24. A B C D E | 65. A B C D E | 106. A B C D E |
| 25. A B C D E | 66. A B C D E | 107. A B C D E |
| 26. A B C D E | 67. A B C D E | 108. A B C D E |
| 27. A B C D E | 68. A B C D E | 109. A B C D E |
| 28. A B C D E | 69. A B C D E | 110. A B C D E |
| 29. A B C D E | 70. A B C D E | 111. A B C D E |
| 30. A B C D E | 71. A B C D E | 112. A B C D E |
| 31. A B C D E | 72. A B C D E | 113. A B C D E |
| 32. A B C D E | 73. A B C D E | 114. A B C D E |
| 33. A B C D E | 74. A B C D E | 115. A B C D E |
| 34. A B C D E | 75. A B C D E | 116. A B C D E |
| 35. A B C D E | 76. A B C D E | 117. A B C D E |
| 36. A B C D E | 77. A B C D E | 118. A B C D E |
| 37. A B C D E | 78. A B C D E | 119. A B C D E |
| 38. A B C D E | 79. A B C D E | 120. A B C D E |
| 39. A B C D E | 80. A B C D E | 121. A B C D E |
| 40. A B C D E | 81. A B C D E | 122. A B C D E |
| 41. A B C D E | 82. A B C D E | 123. A B C D E |

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| 124. A B C D E | 133. A B C D E | 142. A B C D E |
| 125. A B C D E | 134. A B C D E | 143. A B C D E |
| 126. A B C D E | 135. A B C D E | 144. A B C D E |
| 127. A B C D E | 136. A B C D E | 145. A B C D E |
| 128. A B C D E | 137. A B C D E | 146. A B C D E |
| 129. A B C D E | 138. A B C D E | 147. A B C D E |
| 130. A B C D E | 139. A B C D E | 148. A B C D E |
| 131. A B C D E | 140. A B C D E | 149. A B C D E |
| 132. A B C D E | 141. A B C D E | 150. A B C D E |

You are finished with this assignment, please fax or e-mail the answer key and registration form to TLC. Always call to ensure we've received the assignment. Thank you.

Please fax or e-mail the answer key to TLC
Western Campus Fax (928) 272-0747.

Rush Grading Service

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

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...

In the near future, we will stop mailing the certificate of completion so we need either your fax number or e-mail address. We will e-mail the certificate to you, if no e-mail address; we will fax it to you.

**Cross-Connection Identification 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.

1. Please rate the difficulty of your course.
Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.
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.
Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course? _____

How about the price of the course?

Poor _____ Fair _____ Average _____ Good _____ Great _____

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Poor _____ Fair _____ Average _____ Good _____ Great _____

Any other concerns or comments.

CROSS-CONNECTION IDENTIFICATION CEU COURSE ASSIGNMENT

The focus of this course is a basic understanding of Backflow Prevention/Cross-Connection. This course is **NOT** designed to certify you as a General Tester or a Cross-Connection Specialist.

You will have 90 days from receipt of this course to complete in order to receive your Continuing Education Units (**CEUs**) or Professional Development Hours (**PDHs**).

A score of 70 % or better is necessary to pass this course. If you should need any assistance, please email all concerns and the final test to info@tlch2o.com. You can find online assistance for this course on the in the Search function on Adobe Acrobat PDF to help find the answers.

Please include your name and address on your Answer Sheet.

One answer per question. List the exact answer as in text.

Pascal's Law

1. The foundation of _____ was established when Pascal discovered that pressure in a fluid acts equally in all directions.
 - A. Modern hydraulics
 - B. Studying liquids at a specific depth
 - C. Understanding that liquid is independent
 - D. Learning of the weight of a liquid
 - E. None of the Above
2. This pressure acts at right angles to the containing surfaces. If some type of pressure gauge, with an exposed face, is placed beneath the surface of a _____ and pointed in different directions, the pressure will read the same.
 - A. Fluid
 - B. Liquid at a specific depth
 - C. Liquid is independent
 - D. Weight of a liquid
 - E. None of the Above
3. We can say that pressure in a(n) _____ of direction.
 - A. Small area
 - B. Liquid at a specific depth
 - C. Liquid is independent
 - D. Weight
 - E. None of the Above
4. Pressure due to the _____, at any level, depends on the depth of the fluid from the surface.
 - A. Hydraulics
 - B. Liquid at a specific depth
 - C. Gravity
 - D. Weight of a liquid
 - E. None of the Above

5. If the exposed face of the pressure gauges are moved closer to the surface of the liquid, the indicated _____.
- A. Depth is doubled
 - B. Pressure will be less
 - C. Pressure of a liquid is more
 - D. Column pressure is tripled
 - E. None of the Above
6. When the _____, the indicated pressure is doubled. Thus the pressure in a liquid is directly proportional to the depth.
- A. Depth is doubled
 - B. Pressure is less
 - C. Pressure of a liquid is doubled
 - D. Column is tripled
 - E. None of the Above
7. Since there are 144 square inches in 1 square foot, this can be stated as follows: the weight of a column of water 1 foot high, having a cross-sectional area of 1 square inch, is 0.433 pound. If the depth of the _____, the weight of the column will be 3 x 0.433, or 1.299 pounds, and the pressure at the bottom will be 1.299 lb/in² (psi), since pressure equals the force divided by the area.
- A. Depth
 - B. Pressure
 - C. Liquid
 - D. Column is tripled
 - E. None of the Above
8. Thus, the pressure at any depth in a _____ of the column of liquid at that depth divided by the cross-sectional area of the column at that depth.
- A. Tube
 - B. Liquid is equal to the weight
 - C. Pressure
 - D. Gauge
 - E. None of the Above
9. The _____ that produces the pressure is referred to as the fluid head of the liquid.
- A. Velocity
 - B. Pressure
 - C. Volume of a liquid
 - D. Column
 - E. None of the Above
10. The _____ due to its fluid head is also dependent on the density of the liquid.
- A. Velocity
 - B. Pressure
 - C. Pressure of a liquid
 - D. Column is tripled
 - E. None of the Above

Gravity

11. Gravity is one of the four forces of nature. The strength of the gravitational force between two objects depends on their _____.

- A. Areas
- B. Directions
- C. Masses
- D. Forces
- E. None of the Above

12. The more _____ the objects are, the stronger the gravitational attraction.

- A. Gravity
- B. Directions
- C. Massive
- D. Force
- E. None of the Above

13. When you pour water out of a container, the earth's _____ pulls the water towards the ground.

- A. Gravity
- B. Force
- C. Mass
- D. Gravitational force or pull
- E. None of the Above

14. _____, applied forces, and atmospheric pressure are static factors that apply equally to fluids at rest or in motion, while inertia and friction are dynamic factors that apply only to fluids in motion.

- A. Gravity
- B. Pressure
- C. Mass X Force
- D. Velocity
- E. None of the Above

15. The mathematical sum of _____, applied force, and atmospheric pressure is the static pressure obtained at any one point in a fluid at any given time.

- A. Gravity
- B. Pressure
- C. Mass X Force
- D. Velocity
- E. None of the Above

Static Pressure

16. Static pressure exists in addition to any _____ that may also be present at the same time.

- A. Gravity
- B. Directions
- C. Masses
- D. Force
- E. None of the Above

17. Pascal's law states that a pressure set up in a fluid acts equally in all _____ and at right angles to the containing surfaces. This covers the situation only for fluids at rest or practically at rest. It is true only for the factors making up static head.

- A. Liquids
- B. Directions
- C. Mass
- D. Force
- E. None of the Above

18. When velocity becomes a factor it must have a direction, and as previously explained, 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. Weight
- B. Fluid power
- C. Mass
- D. Force
- E. None of the Above

19. 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. Gravity
- B. Weight
- C. Friction head
- D. Force
- E. None of the Above

20. _____, which can be produced by pressure or head when dealing with fluids, is necessary to start a body moving if it is at rest, and is present in some form when the motion of the body is arrested.

- A. Gravity
- B. Weight
- C. Masses
- D. Force
- E. None of the Above

Volume and Velocity of Flow

21. The _____ passing a point in a given time is known as its volume of flow or flow rate.

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

22. The _____ 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. Velocity of flow
- C. Volume of flow
- D. Speed of a liquid
- E. None of the Above

23. The _____ or velocity of the fluid is defined as the average speed at which the fluid moves past a given point. It is usually expressed in feet per second (fps) or feet per minute (fpm).

- A. Pressure drop
- B. Velocity of flow
- C. Volume of flow
- D. Speed
- E. None of the Above

24. _____ is an important consideration in sizing the hydraulic lines.

- A. Pressure drop
- B. Velocity of flow
- C. Volume of flow
- D. Speed
- E. None of the Above

25. Volume and _____ are often considered together. With other conditions unaltered—that is, with volume of input unchanged—the velocity of flow increases as the cross section or size of the pipe decreases, and the velocity of flow decreases as the cross section increases.

- A. Pressure drop
- B. Velocity of flow
- C. Volume of flow
- D. Weight
- E. None of the Above

Bernoulli's Principle

26. 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 _____, and conversely, if an increase (decrease) in, the speed of the fluid results in a decrease (or increase) in the pressure.

- A. Pressure drop
- B. Velocity of flow
- C. Volume of flow
- D. Speed
- E. None of the Above

27. 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 _____ inside the curtain (relative to the still air on the other side) causes a pressure drop.

- A. Pressure
- B. Velocity
- C. Volume of flow
- D. Speed
- E. None of the Above

28. The _____ difference between the outside and inside causes a net force on the shower curtain which sucks it inward.

- A. Pressure
- B. Velocity of flow
- C. Volume of flow
- D. Speed
- E. None of the Above

29. A more useful example is provided by the functioning of a perfume bottle: 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. Velocity of flow
- C. Volume of flow
- D. Speed
- E. None of the Above

30. _____ also tells us 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 methods of measurements
- B. Bernoulli's principle
- C. Velocity changes
- D. Conservation of energy
- E. None of the Above

31. The difference in force pushes the windows outward, and hence they explode. If you know that a hurricane is coming it is therefore better to open as many windows as possible, to equalize the _____.

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

32. 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 effect
- B. Bernoulli's principle
- C. Velocity changes
- D. Conservation of energy effects
- E. None of the Above

Understanding the Venturi

33. It is not easy to understand the reason low pressure occurs in the small diameter area of the venturi. This explanation may seem to help the _____.

- A. Venturi to operate
- B. Principle
- C. Velocity changes
- D. Conservation of energy
- E. None of the Above

34. It is clear that all the flow must pass from the _____ to the smaller section.

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

35. In other words, the _____ will remain the same in the large and small portions of the tube.
- A. Venturi
 - B. Bernoulli's principle
 - C. Velocity changes
 - D. Conservation of energy
 - E. None of the Above
36. The flow rate is the same rate, but the _____. The velocity is greater in the small portion of the tube.
- A. Venturi stays the same
 - B. Bernoulli's principle changes
 - C. Velocity changes
 - D. Conservation of energy
 - E. None of the Above
37. There is a relationship between the pressure energy and the _____ energy; if velocity increases the pressure energy must decrease.
- A. Venturi
 - B. Bernoulli's principle
 - C. Velocity
 - D. Conservation of energy
 - E. None of the Above
38. This is known as the principle of _____ at work which is also Bernoulli's law.
- A. Venturi deflection
 - B. Bernoulli's principle
 - C. Velocity changes
 - D. Conservation of energy
 - E. None of the Above
39. Pressure and _____ energies behave in the same way. In the large part of the pipe the pressure is high and velocity is low, in the small part, pressure is low and velocity high.
- A. Weight
 - B. Bernoulli's principle
 - C. Velocity
 - D. Conservation of energy
 - E. None of the Above
40. 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
 - B. Backpressure
 - C. Backsiphonage
 - D. Cross-connection
 - E. None of the Above
41. There are two types of backflow--_____ and backsiphonage.
- A. Backflow
 - B. Backpressure
 - C. Backsiphonage
 - D. Cross-connection
 - E. None of the Above

42. A _____ is any temporary or permanent connection between a public water system or consumer's potable (i.e., drinking) water system and any source or system containing nonpotable water or other substances.

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

43. _____ 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
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. None of the Above

44. _____ can occur when there is a stoppage of water supply due to nearby fire fighting, a break in a water main, etc.

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

45. _____ backflow is 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. Reverse
- B. Backpressure
- C. Backsiphonage
- D. Cross-connection
- E. None of the Above

46. _____ (i.e., downstream pressure that is greater than the potable water supply pressure) can result from an increase in downstream pressure, a reduction in the potable water supply pressure, or a combination of both.

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

47. _____ in potable water supply pressure occur whenever the amount of water being used exceeds the amount of water being supplied, such as during water line flushing, fire fighting, or breaks in water mains.

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

48. A(n) _____ is a means or mechanism to prevent backflow.
- A. High hazard RP
 - B. Air gapper
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above
49. Basic means of preventing backflow is a(n) _____, which either eliminates a cross-connection or provides a barrier to backflow.
- A. High hazard device
 - B. Air gap
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above
50. The basic mechanism for preventing backflow is a mechanical _____, which provides a physical barrier to backflow.
- A. Installations
 - B. Backflow preventer
 - C. Barrier to backflow
 - D. Approved air gap
 - E. None of the Above
51. The principal types of mechanical backflow preventer are the reduced-pressure principle assembly, the _____, and the double check valve assembly.
- A. Check valve
 - B. Air gap
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above

Types of Backflow Prevention Methods and Assemblies

52. _____ 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. None of the Above
53. The type of device selected for a _____ on several factors.
- A. High hazard installations
 - B. Air gap
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above
54. The _____ must be assessed.
- A. High hazard installations
 - B. Air gap
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above

55. A(n) _____ 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. High hazard device
 - B. Backflow preventer
 - C. Barrier to backflow
 - D. Approved air gap
 - E. None of the Above
56. These air gap separations must be vertically orientated a distance of at least twice the inside diameter of the _____, but never less than one inch.
- A. High hazard installations
 - B. Air gap
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above
57. An obstruction around or near a(n) _____ may restrict the flow of air into the outlet pipe and nullify the effectiveness of the air gap to prevent backsiphonage.
- A. High hazard device
 - B. Backflow preventer
 - C. Barrier to backflow
 - D. Air gap
 - E. None of the Above
58. When the air flow is restricted, such as the case of an air gap located near a wall, the _____ separation must be increased.
- A. High hazard device
 - B. Air gap
 - C. Backflow preventer
 - D. Backflow
 - E. None of the Above
59. A building where the air pressure is artificially increased above atmospheric, such as a sports stadium with a flexible roof kept in place by air blowers, the _____ separation must be increased.
- A. High hazard device
 - B. Air gap
 - C. Backflow preventer
 - D. Space
 - E. None of the Above
60. An air gap is a physical disconnection between the free flowing discharge end of a potable water pipeline and the top of a(n) _____.
- A. High hazard installations
 - B. Backflow preventer
 - C. Barrier to backflow
 - D. Air gap
 - E. None of the Above
61. The _____ must be at least two times the diameter of the supply pipe and not less than one inch.
- A. High hazard installations
 - B. Air gap
 - C. Backflow preventer
 - D. None of the Above

62. This type of protection is acceptable for _____ and is theoretically the most effective protection.

- A. High hazard installations
- B. All installations
- C. Barrier installations
- D. Approved air gap installations
- E. None of the Above

63. However, this method of prevention can be circumvented if the _____ is extended.

- A. High hazard installations
- B. Air gap
- C. Backflow preventer
- D. Backflow
- E. None of the Above

Vacuum Breakers

64. There are two types of _____, atmospheric and pressure.

- A. Check valves
- B. Atmospheric vacuum breakers
- C. Vacuum breakers
- D. Hazard applications
- E. None of the Above

65. The difference between the two types them is that the pressure _____ is spring loaded to assist the device's opening.

- A. Downstream piping
- B. Atmospheric vacuum breakers
- C. Vacuum breaker
- D. Hazard applications
- E. None of the Above

66. Both devices open the pipeline to atmosphere in the event of backsiphonage only. Neither _____ is approved for backpressure conditions.

- A. Downstream piping
- B. Atmospheric vacuum breakers
- C. Device
- D. Hazard applications
- E. None of the Above

67. Both devices are only suitable for low _____. Their primary purpose is to protect the water system from cross connections due to submerged inlets, such as irrigation systems and tank applications.

- A. Downstream piping
- B. Atmospheric vacuum breakers
- C. Vacuum breakers
- D. Hazard applications
- E. None of the Above

68. Shutoff valves may not be installed _____ of atmospheric vacuum breakers but are allowed on pressure vacuum breakers.

- A. Downstream
- B. On most atmospheric vacuum breakers
- C. On several vacuum breakers
- D. Without knowing the hazard applications
- E. None of the Above

69. The devices must be installed above the highest _____.
- Downstream piping
 - Atmospheric vacuum breaker
 - Point
 - Hazard application
 - None of the Above
70. Atmospheric Vacuum Breaker (AVB) contains a float check (_____), a check seat, and an air inlet port.
- Air inlet
 - Atmospheric vacuum breakers
 - Device
 - Hazard applications
 - None of the Above
71. The _____ allows air to enter the water line when the line pressure is reduced to a gauge pressure of zero or below.
- Air inlet
 - Vacuum breakers
 - Device
 - Air port
 - None of the Above
72. The _____ valve is not internally loaded.
- Air inlet
 - Air relief
 - Release
 - Dump
 - None of the Above
73. To prevent the _____ from sticking closed, the device must not be installed on the pressure side of a shutoff valve, or wherever it may be under constant pressure more than 12 hours during a 24 hour period.
- Air inlet
 - Atmospheric vacuum breaker
 - Device
 - Dumper
 - None of the Above
74. _____ are designed to prevent backflow caused by backsiphonage only from low health hazards.
- Air inlets
 - Atmospheric vacuum breakers
 - Devices
 - Relief valves
 - None of the Above
75. _____ Uses: Irrigation systems, commercial dishwasher and laundry equipment, chemical tanks and laboratory sinks (backsiphonage only, nonpressurized connections.)
- Air inlets
 - Atmospheric vacuum breakers
 - Devices
 - Hazard applications
 - None of the Above

76. Pressure Vacuum Breaker Assembly (PVB) consists of a spring loaded check valve, an independently operating air inlet valve, two resilient seated shutoff valves, and two properly located resilient seated _____. It shall be installed as a unit as shipped by the manufacturer.

- A. Valve assemblies
- B. Test cocks
- C. Air inlet valves
- D. Internally weighted checks
- E. None of the Above

77. The _____ is internally loaded to the open position, normally by means of a spring, allowing installation of the assembly on the pressure side of a shutoff valve.

- A. Air relief
- B. Test cocks
- C. Air inlet valve
- D. Internally weighted check
- E. None of the Above

78. The PVB needs to be installed 12 inches above the _____ to work correctly.

- A. Valve assembly
- B. Test cocks
- C. Air inlet valve
- D. Internally weighted
- E. None of the Above

79. Double Check Valve Assembly (DC) consists of two internally loaded check valves, either spring loaded or internally weighted, two resilient seated full ported shutoff valves, and four properly located resilient seated _____.

- A. Air reliefs
- B. Test cocks
- C. Air inlet valve
- D. Dump valve
- E. None of the Above

80. The double check _____ is designed to prevent backflow caused by backpressure and backsiphonage from low health hazards or pollutional concerns only.

- A. Valve assembly
- B. Test cocks
- C. Air inlet valve
- D. None of the Above

81. The double check valve should be installed in a(n) _____ and protected from freezing.

- A. Spring loaded box
- B. Accessible location
- C. Above the ground location 24 inches min.
- D. None of the Above

82. The DC needs to be installed 12 inches _____ for testing purposes only.

- A. And spring loaded
- B. To be maintained at a lower pressure
- C. Above the ground
- D. None of the Above

83. Reduced Pressure Backflow Assembly (RP) consists of two independently acting spring loaded check valves separated by a(n) _____ differential pressure relief valve, two resilient seated full ported shutoff valves, and four properly located resilient seated test cocks.
- Spring loaded
 - Accessible turn-off
 - Lower pressure
 - Relief
 - None of the Above
84. During normal operation, the pressure between the two check valves, referred to as the zone of reduced pressure, _____ than the supply pressure.
- Is spring loaded
 - Is equal
 - Is maintained at a lower pressure
 - Is higher
 - None of the Above
85. If either reduced pressure backflow assembly check valve leaks, the differential pressure relief valve maintains a differential pressure of at least two (2) psi between the supply pressure and the _____ between the two check valves by discharging water to atmosphere.
- Zone
 - RP cocks
 - Relief port
 - Dump will operate
 - None of the Above
86. The _____ is designed to prevent backflow caused by backpressure and backsiphonage from low to high health hazards. The RP needs to be installed 12 inches above the ground for testing purposes only.
- Reduced pressure zone port
 - Reduced pressure backflow assembly or RP
 - Check valve
 - Air gap
 - None of the Above
87. The _____ consists of two internally loaded (weighted or spring loaded) check valves separated by a reduced pressure zone with a relief port to vent water to the atmosphere.
- Reduced pressure zone port
 - Reduced pressure backflow assembly or RP
 - Check valve
 - Air gap
 - None of the Above
88. The _____ device can be used for high hazard situations under both backpressure and backsiphonage conditions. Under normal conditions, the second check valve should prevent backflow.
- Reduced pressure zone port
 - Reduced pressure
 - Backpressure device
 - Air gap
 - None of the Above

89. If the second check valve fails or becomes fouled and backflow into the reduced pressure zone occurs, the relief port vents the _____ to atmosphere.

- A. Reduced pressure zone port
- B. Reduced pressure backflow assembly or RP
- C. Backflow
- D. Air gaps
- E. None of the Above

90. The _____ opens anytime pressure in the zone comes within 2 psi of the supply pressure.

- A. Reduced pressure zone port
- B. Hydraulic valve
- C. Pressure area
- D. Dump zone
- E. None of the Above

Why do Backflow Preventors have to be Tested Periodically?

91. Mechanical backflow preventors have internal _____ that are subject to fouling, wear, or fatigue.

- A. Reduced pressure zone port
- B. Reduced pressure backflow assembly or RP
- C. Backpressure and backsiphonage
- D. Air gaps
- E. None of the Above

92. Mechanical backflow preventors and _____ can be bypassed.

- A. Reduced pressure zone ports
- B. Reduced pressure backflow assembly or RP
- C. Backpressure and backsiphonage devices
- D. Air gaps
- E. None of the Above

Backflow Introduction

93. Backflow prevention, also referred to as _____, addresses a serious health issue.

- A. Enforcement responsibility(Water Providers)
- B. Federal code
- C. Program regulation
- D. Cross-Connection Control
- E. None of the Above

94. The above issue was addressed on the _____ by passage of the "Federal Safe Drinking Water Act" as developed by the Environmental Protection Agency (E.P.A.).

- A. Enforcement responsibility
- B. Federal level
- C. Program regulation
- D. Cross-Connection Control
- E. None of the Above

95. This Act tasked each state with primary _____ for a program to assure access to safe drinking water by all citizens.

- A. Enforcement responsibility
- B. Federal level assistance
- C. Program regulation control
- D. Cross-Connection Control
- E. None of the Above

96. Such _____ as adopted 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 are good
 - C. State program regulations
 - D. Cross-Connection Control
 - E. None of the Above
97. The official definition of a _____ is "the link or channel connecting a source of pollution with a potable water supply."
- A. Legal responsibility
 - B. Federal level
 - C. Program regulation
 - D. Cross-Connection program
 - E. None of the Above
98. There are two distinct levels of concern with this issue. The first is protection of the general _____ of persons subject to such risks involving service to a single customer, be that customer an individual residence or business.
- A. Internal or external piping
 - B. Public and the second is protection
 - C. Residential environment the pollutant source
 - D. Usually intentional
 - E. None of the Above
99. Sources of pollution which may result in a danger to health are not always obvious and such cross-connections are _____. They are usually the result of oversight or a non-professional installation.
- A. Internal or external piping areas
 - B. Public and the second is protection
 - C. Residential environment the pollutant source
 - D. Certainly not usually intentional
 - E. None of the Above
100. As source examples, within a business environment the pollutant source may involve the unintentional cross-connection of _____ with chemical processes or a heating boiler.
- A. Internal or external piping
 - B. Public and the second is protection
 - C. Residential environment the pollutant source
 - D. Certainly not usually intentional
 - E. None of the Above
101. In a(n) _____ may be an improper cross-connection with a landscape sprinkler system or reserve tank fire protection system.
- A. Internal or external piping situation
 - B. Public and the second is protection
 - C. Residential environment the pollutant source
 - D. Certainly not usually intentional
 - E. None of the Above

102. A(n) _____ a garden hose nozzle submerged in a bucket of liquid or attached to a chemical sprayer.

- A. Situation as simple as leaving
- B. Bad connection is
- C. Great connection is
- D. Example is
- E. None of the Above

103. Another potential hazard source within any environment may be a cross-connection of piping _____ on the property.

- A. Involving a water well located
- B. To a water meter
- C. For a cooling tower
- D. To a garden hose
- E. None of the Above

104. There are many other potential sources of pollutant hazards. Control of cross-connections is possible but _____.

- A. Only through knowledge and vigilance
- B. Needs public education
- C. Needs to be enforced
- D. Certainly intentional
- E. None of the Above

105. Public education is essential, for _____ in piping and plumbing installations fail to recognize cross-connection dangers.

- A. Many that are educated
- B. Public safety
- C. Residential environment the pollutant source
- D. All homes
- E. None of the Above

Hydraulics

106. Definition: Hydraulics is a branch of engineering concerned mainly with moving liquids. The term is applied commonly to the study of the _____, other liquids, and even gases when the effects of compressibility are small.

- A. Hydraulic properties of water
- B. Hydrostatic properties of water
- C. Hydrokinetic properties of water
- D. Mechanical properties of water
- E. None of the Above

107. Hydraulics can be divided into two areas, _____ and hydrokinetics.

- A. Hydraulics
- B. Hydrostatics
- C. Hydrokinetics
- D. Mechanical properties
- E. None of the Above

108. Hydraulics: The Engineering science pertaining to liquid _____ and flow.

- A. Movements
- B. Study
- C. Science
- D. Pressure
- E. None of the Above

109. The word _____ 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. Hydraulics
- B. Hydrostatics
- C. Hydrokinetics
- D. Hydro
- E. None of the Above

110. Use of the word _____ has broadened its meaning to include the behavior of all liquids, although it is primarily concerned with the motion of liquids.

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

111. Hydraulics includes the manner in which _____ in tanks and pipes, deals with their properties, and explores ways to take advantage of these properties.

- A. Hydraulic act
- B. Liquids act
- C. Hydrokinetics reacts
- D. Pressure moves
- E. None of the Above

112. _____, the consideration of liquids at rest, involves problems of buoyancy and flotation, pressure on dams and submerged devices, and hydraulic presses. The relative incompressibility of liquids is one of its basic principles.

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

113. _____, the study of liquids in motion, is concerned with such matters as friction and turbulence generated in pipes by flowing liquids, the flow of water over weirs and through nozzles, and the use of hydraulic pressure in machinery.

- A. Hydrodynamics
- B. Hydrostatics
- C. Hydrokinetics
- D. Pressure
- E. None of the Above

114. _____ is about the pressures exerted by a fluid at rest. Any fluid is meant, not just water.

- A. Hydrodynamics
- B. Hydrostatics
- C. Hydrokinetics
- D. Pressure
- E. None of the Above

115. _____ is an excellent example of deductive mathematical physics, one that can be understood easily and completely from a very few fundamentals, and in which the predictions agree closely with experiment.

- A. Hydrodynamics
- B. Hydrostatics
- C. Hydrokinetics
- D. Pressure
- E. None of the Above

116. Although time is not a factor in _____, it enters in the approach to hydrostatic equilibrium. It is usually stated that a fluid is a substance that cannot resist a shearing stress, so that pressures are normal to confining surfaces.

- A. Hydrodynamics
- B. Hydrostatics
- C. Hydrokinetics
- D. Pressure
- E. None of the Above

117. _____ has now shown us clearly that there are substances which can resist shearing forces over short time intervals, and appear to be typical solids, but which flow like liquids over long time intervals.

- A. Hydrodynamics
- B. Hydrostatics
- C. Hydrokinetics
- D. Pressure
- E. None of the Above

Atmospheric Pressure

118. The atmosphere is the entire _____ of air that surrounds the earth.

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

119. While the atmosphere 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. This layer is called the _____.

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

120. If a column of air 1-inch square extending all the way to the "_____ " of the atmosphere could be weighed, this column of air would weigh approximately 14.7 pounds at sea level.

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

121. Atmospheric pressure at _____ is approximately 14.7 psi.
- A. Column
 - B. Troposphere
 - C. Sea level
 - D. Mass
 - E. None of the Above
122. As one ascends the _____ decreases by approximately 1.0 psi for every 2,343 feet.
- A. Atmospheric pressure
 - B. Sea level pressure
 - C. Air mass
 - D. Column of water
 - E. None of the Above
123. Below _____, in excavations and depressions, atmospheric pressure increases.
- A. Troposphere
 - B. Sea level
 - C. Ground
 - D. Water
 - E. None of the Above
124. Pressures under water differ from those under air only because the weight of the water must be added to the _____ of the air.
- A. Barometer
 - B. Pressure(s)
 - C. Height
 - D. Altitude
 - E. None of the Above
125. Atmospheric pressure can be measured by any of several methods. The common laboratory method uses the mercury _____ barometer.
- A. Barometer
 - B. Pressure(s)
 - C. Height
 - D. Altitude
 - E. None of the Above
126. The _____ of the mercury column serves as an indicator of atmospheric pressure. At sea level and at a 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. Barometer
 - B. Pressure(s)
 - C. Height
 - D. Altitude
 - E. None of the Above
127. Another device used to measure atmospheric pressure is the aneroid _____.
- A. Barometer
 - B. Pressure(s)
 - C. Measurement
 - D. Gauge
 - E. None of the Above

128. The aneroid _____ uses the change in shape of an evacuated metal cell to measure variations in atmospheric pressure.

- A. Barometer
- B. Pressure(s)
- C. Measurement
- D. Gauge
- E. None of the Above

129. The thin metal of the aneroid cell moves in or out with the variation of pressure on its external surface. This movement is transmitted through a system of levers to a pointer, which indicates the _____.

- A. Barometer
- B. Pressure(s)
- C. Height
- D. Altitude
- E. None of the Above

130. The atmospheric pressure does not vary uniformly with _____. It changes very rapidly.

- A. Gravity
- B. Pressure(s)
- C. Height
- D. Altitude
- E. None of the Above

131. Atmospheric pressure is defined as the force per unit area exerted against a surface by the _____ of the air above that surface.

- A. Pressure PGIA
- B. Pressure(s)
- C. Weight
- D. Altitude
- E. None of the Above

Barometric Loop

132. The barometric loop consists of a continuous section of supply piping that abruptly rises to a height of approximately 35 feet and _____ to the originating level.

- A. Will not rise
- B. That effectively protects
- C. Then returns back down
- D. None of the Above

133. The barometric loop is a loop in the piping system _____ against backsiphonage.

- A. Returns back down
- B. Referred to using
- C. Will rise
- D. That effectively protects
- E. None of the Above

134. The barometric loop _____ to protect against back-pressure.

- A. Will not rise
- B. Effectively protects
- C. May not be used
- D. Is excellent
- E. None of the Above

135. Its operation, in the protection against backsiphonage, is based upon the principle that a water column, at sea level pressure, _____ above 33.9 feet. In general, barometric loops are locally fabricated, and are 35 feet high.

- A. Works
- B. Will have effects
- C. Will not rise
- D. Effectively protects
- E. None of the Above

136. Pressure may be _____ an absolute scale, pounds per square inch absolute (psia), or gauge scale, (psiag).

- A. Backed down
- B. Referred to using
- C. Less
- D. Stronger than
- E. None of the Above

137. Absolute pressure and gauge pressure _____. Absolute pressure is equal to gauge pressure plus the atmospheric pressure.

- A. Are the same
- B. Referred as the same
- C. Are related
- D. Are equal
- E. None of the Above

138. At sea level, the _____ is 14.7 psai.

- A. Absolute pressure
- B. Fluid
- C. Volume
- D. Atmospheric pressure
- E. None of the Above

139. _____ is the total pressure.

- A. Absolute pressure
- B. Atmospheric pressure
- C. Fluid pressure
- D. Volume pressure
- E. None of the Above

140. 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. Then the _____ would be equal to 14.7 psi, which is the atmospheric pressure.

- A. Absolute pressure
- B. Atmospheric pressure
- C. Fluid pressure
- D. Volume pressure
- E. None of the Above

Pressure

141. By a _____, we have a material in mind like water or air, two very common and important fluids.

- A. Absolute pressure
- B. Fluid
- C. Fluid pressure
- D. Volume pressure
- E. None of the Above

142. Water is incompressible, while air is very compressible, but both are _____.
- A. Absolute pressure
 - B. Atmospheric pressure
 - C. Fluid
 - D. Volume
 - E. None of the Above
143. Water has a definite _____; air does not.
- A. Absolute pressure
 - B. Fluid
 - C. Volume
 - D. Atmospheric pressure
 - E. None of the Above
144. Water and air have _____; that is, layers of them slide very easily on one another, and they quickly assume their permanent shapes when disturbed by rapid flows.
- A. Absolute pressure
 - B. Fluid
 - C. Atmospheric pressure
 - D. Volume
 - E. None of the Above
145. Other fluids, such as molasses, may have high viscosity and take a long time to come to equilibrium, but they are no less _____.
- A. Absolute pressure
 - B. Fluid(s)
 - C. Volume
 - D. Atmospheric pressure
 - E. None of the Above
146. The coefficient of viscosity is the ratio of the _____ to the velocity gradient.
- A. Absolute pressure
 - B. Fluid
 - C. Volume
 - D. Shearing force
 - E. None of the Above
147. _____ 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 principle
 - D. Permanent forces tangential principle
 - E. None of the Above
148. A fluid, therefore, is a substance that cannot exert any _____ to a boundary. Any force that it exerts on a boundary must be normal to the boundary.
- A. Pascal's Principle
 - B. Liquid
 - C. Body of the fluid
 - D. Permanent forces tangential
 - E. None of the Above

149. A force is proportional to the _____, and is called a pressure.

- A. Liquid
- B. Hydrostatic area
- C. Area on which it is exerted
- D. Head
- E. None of the Above

150. In order for any small element of 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 _____, the pressure must be the same at all neighboring points.

- A. Related
- B. Acting on the body of the fluid
- C. Tangential
- D. Hydrostatic related
- E. None of the Above

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