

Registration form

**BACKFLOW AWARENESS CEU TRAINING COURSE \$150.00**  
**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*

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

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

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

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

**Email** \_\_\_\_\_ **Fax (\_\_\_\_\_)** \_\_\_\_\_

**Phone:**  
**Home (\_\_\_\_\_)** \_\_\_\_\_ **Work (\_\_\_\_\_)** \_\_\_\_\_

**Operator ID#** \_\_\_\_\_ **Class/Grade** \_\_\_\_\_

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

Water Treatment \_\_\_\_\_ Distribution \_\_\_\_\_ Collection \_\_\_\_\_ Wastewater Treatment \_\_\_\_\_  
Pump Installer \_\_\_\_\_ CSI \_\_\_\_\_ AWWA Backflow \_\_\_\_\_ Other \_\_\_\_\_

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

Technical Learning College PO Box 3060, Chino Valley, AZ 86323  
Toll Free (866) 557-1746 Fax (928) 272-0747 e-mail info@tlch2o.com

**If you've paid on the Internet, please write your Customer#** \_\_\_\_\_

**Please invoice me, my PO#** \_\_\_\_\_

**Please pay with your credit card on our website under Bookstore or Buy Now. Or call us and provide your credit card information.**

***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.***

**DISCLAIMER NOTICE**

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury, death, neglect, damage caused by this CEU education training or course material suggestion or error.

I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded. 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.

*You can obtain a printed version 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.

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

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

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

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

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

**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.

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

## For Texas TCEQ Wastewater / Collections Operators

### Rule Changes and Updates for Domestic Wastewater Systems

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

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

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

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

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

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

design criteria that preceded Chapter 317 of this title; and (B) systems regulated by Chapter 285 of this title (relating to On-Site Sewage Facilities); or collection systems or wastewater treatment facilities that collect, transport, treat, or dispose of wastewater that does not have the characteristics of domestic wastewater, although the wastewater may contain domestic wastewater.

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

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

Please sign and date this notice

Printed Name

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Signature

Date

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**Texas Students Only**  
**Acknowledgement of Notice of Potential Ineligibility for License**  
*You are required to sign and return to TLC or your credit will not be reported.*

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

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

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

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

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

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

Date: \_\_\_\_\_

Name of Training Provider/Organization: Technical Learning College

Contact Person: Melissa Durbin Role/Title: Dean



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

**Backflow Awareness CEU Training Course  
CUSTOMER SERVICE RESPONSE CARD**

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

**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? \_\_\_\_\_

What would you do to improve the course?

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How about the price of the course?

Poor \_\_\_\_ Fair \_\_\_\_ Average \_\_\_\_ Good \_\_\_\_ Great \_\_\_\_

How was your customer service?

Poor \_\_\_\_ Fair \_\_\_\_ Average \_\_\_\_ Good \_\_\_\_ Great \_\_\_\_

Any other concerns or comments.

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## **Special Notice to all Texas (TCEQ) Students**

§ 344.51. SPECIFIC CONDITIONS AND CROSS-CONNECTION CONTROL.

(d) If an irrigation system is designed or installed on a property that is served by an on-site sewage facility, as defined in Chapter 285 of this title (relating to On-Site Sewage Facilities), then:

(1) all irrigation piping and valves must meet the separation distances from the On-Site Sewage Facilities system as required for a private water line in §285.91(10) of this title (relating to Minimum Required Separation Distances for On-Site Sewage Facilities);

(2) any connections using a private or public potable water source must be connected to the water source through a reduced pressure principle backflow prevention assembly as defined in §344.50 of this title (relating to Backflow Prevention Methods); and

(3) any water from the irrigation system that is applied to the surface of the area utilized by the On-Site Sewage Facility system must be controlled on a separate irrigation zone or zones so as to allow complete control of any irrigation to that area so that there will not be excess water that would prevent the On-Site Sewage Facilities system from operating effectively.



# Backflow Awareness CEU Course Answer Key

Name \_\_\_\_\_

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

*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 \_\_\_\_\_

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

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

PA DEP Students are required to complete the original version of the text. \_\_\_\_\_  
Please initial

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

*Please select one answer. You can Bold, Circle, Underline or X your answer. You can use Adobe Acrobat DC to electronically fill out this sheet.*

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| 2. A B C D E F  | 14. A B C D E F | 26. A B C D E F |
| 3. A B C D E F  | 15. A B C D E F | 27. A B C D E F |
| 4. A B C D E F  | 16. A B C D E F | 28. A B C D E F |
| 5. A B C D E F  | 17. A B C D E F | 29. A B C D E F |
| 6. A B C D E F  | 18. A B C D E F | 30. A B C D E F |
| 7. A B C D E F  | 19. A B C D E F | 31. A B C D E F |
| 8. A B C D E F  | 20. A B C D E F | 32. A B C D E F |
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141. A B C D E F                      163. A B C D E F                      185. A B C D E F  
142. A B C D E F                      164. A B C D E F                      186. A B C D E F  
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144. A B C D E F                      166. A B C D E F                      188. A B C D E F  
145. A B C D E F                      167. A B C D E F                      189. A B C D E F  
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147. A B C D E F                      169. A B C D E F                      191. A B C D E F  
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149. A B C D E F                      171. A B C D E F                      193. A B C D E F  
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159. A B C D E F  
160. A B C D E F

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

*You are finished, please fax or e-mail your assignment and registration page. Call us to ensure we received the assignment. Fax (928) 272-0747*



## **BACKFLOW AWARENESS CEU COURSE ASSIGNMENT**

*You may re-type or use this Word document to assist your 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.

***The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit [www.ABCTL.com](http://www.ABCTL.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**

***One answer per question.***

### **Backflow Introduction**

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

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

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

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

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

4. 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

5. 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

6. 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

7. Sources of pollution which 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

8. Within a business environment, the pollutant source may involve the unintentional cross-connection of \_\_\_\_\_ 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

9. 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

10. 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

11. 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
- B. Backwater
- C. Without a direct connection
- D. Involving a water well located on the property.
- E. Air break
- F. None of the Above

12. 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

13. 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**

14. 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

15. 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

16. Which of the following terms is a type 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

17. 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

18. 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

19. 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

20. 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

21. 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
22. 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
23. \_\_\_\_\_ 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
24. 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
25. \_\_\_\_\_ can 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      D. Cross-connection  
 B. Backpressure      E. Reductions  
 C. Backsiphonage      F. None of the Above

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

26. \_\_\_\_\_ must either be physically disconnected or have an approved backflow prevention device installed to protect the public water system?  
 A. Backflow      D. Cross-connection  
 B. Backpressure      E. Indirect connection  
 C. Backsiphonage      F. None of the Above
27. The type of device selected for a particular installation depends on several factors.  
 A. True      B. False
28. When the air flow is restricted, such as the case of an air gap located near a wall, the \_\_\_\_\_ separation must be increased.  
 A. Open receiving vessel      D. Air gap  
 B. Backflow preventer      E. Air break  
 C. Barrier to backflow      F. None of the Above



29. 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

30. 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

31. 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

32. 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

33. 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

34. 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 pollutional hazards
- E. High pollutional concerns
- F. None of the Above

### **Vacuum Breakers**

35. Which of the following terms can have two types: atmospheric and pressure.

- A. Downstream piping
- B. Atmospheric vacuum breakers
- C. Vacuum breaker(s)
- D. Hazard application(s)
- E. Backflow preventor(s)
- F. None of the Above

36. Both vacuum breakers devices primary purpose is to protect the water system from cross connections due to submerged inlets, such as irrigation systems and tank applications.

- A. True
- B. False

37. The difference between the two types them is that the pressure vacuum breaker \_is spring loaded to assist the device's opening.

- A. True
- B. False

38. Both vacuum breakers devices open the pipeline to atmosphere in the event of backsiphonage only.  
A. True    B. False
39. Both vacuum breakers devices are approved for backpressure conditions.  
A. True    B. False
40. Both vacuum breakers devices are only suitable for?  
A. High hazard installations            D. Low hazard conditions  
B. Backflow preventer                    E. High pollutional concerns  
C. Barrier to backflow                    F. None of the Above
41. Which of the following terms may not be installed downstream of atmospheric vacuum breakers but are allowed on pressure vacuum breakers?  
A. Valve assembly                        D. Internally weighted  
B. Test cocks                                E. Shut offs  
C. Air inlet valve                            F. None of the Above
42. The devices must be installed above the highest?  
A. Downstream piping                    D. Hazard applications  
B. Atmospheric vacuum breakers       E. Mountain  
C. Vacuum breakers                        F. None of the Above
43. Which of the following terms contains a float check, a check seat, and an air inlet port?  
A. Double check                            D. RP  
B. Atmospheric vacuum breaker        E. Backflow preventor(s)  
C. Breaker(s)                                F. None of the Above
44. The Atmospheric vacuum breaker allows air to enter the water line when the line pressure is reduced to a gauge pressure of zero or below.  
A. True    B. False
45. Which of the following terms is not internally loaded?  
A. Air inlet valve    D. Test cock  
B. Check valve        E. Atmospheric vacuum breakers  
C. Device                F. None of the Above
46. To prevent the Air inlet from sticking open, the device must not be installed on the pressure side of a shutoff valve, or wherever it may be under constant pressure more than 2 hours during a 12-hour period.  
A. True    B. False
47. Which of the following terms are designed to prevent backflow caused by backsiphonage only from low health hazards?  
A. Downstream piping                    D. Hazard application(s)  
B. Atmospheric vacuum breakers       E. Backflow preventor(s)  
C. RPs                                        F. None of the Above

48. Atmospheric vacuum breakers Uses: Irrigation systems, commercial dishwasher and laundry equipment, chemical tanks and laboratory sinks.

A. True    B. False

49. Pressure Vacuum Breaker Assembly (PVB) consists of a weighted check valve, an independently operating relief valve, two resilient seated shutoff valves, and two properly located resilient seated test cocks.

A. True    B. False

50. The PVB needs to be installed 12 inches above the service or supply line to work correctly.

A. True    B. False

51. 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 test cocks

A. True    B. False

52. The double check valve assembly is designed to prevent backflow caused by backpressure and backsiphonage from high health hazards.

A. True    B. False

53. The double check valve should be installed in an \_\_\_\_\_ and protected from freezing.

- |                        |                                      |
|------------------------|--------------------------------------|
| A. Confined space      | D. In a pit                          |
| B. Accessible location | E. Is maintained at a lower pressure |
| C. Above the ground    | F. None of the Above                 |

54. The DC needs to be installed 12 inches \_\_\_\_\_ for testing purposes only.

- |                        |  |
|------------------------|--|
| A. in a Confined space | D. In a pit                            |
| B. Accessible location | E. Above the highest downstream outlet |
| C. Above the ground    | F. None of the Above                   |

55. Reduced Pressure Backflow Assembly (RP) consists of two independently acting spring loaded check valves separated by a Spring loaded differential pressure relief valve, two resilient seated full ported shutoff valves, and four properly located resilient seated test cocks.

A. True    B. False

56. During normal operation, the pressure between the two check valves, referred to as the air inlet zone, is maintained at a higher pressure than the supply pressure.

A. True    B. False

57. 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 zone between the two check valves by discharging water to atmosphere.

A. True    B. False

58. According to the text, the reduced pressure backflow assembly or RP is designed to prevent backflow caused by backpressure and backsiphonage from low to high health hazards.

- A. True      B. False

59. According to the text, the RP needs to be installed 12 inches above the ground for testing purposes only.

- A. True      B. False

60. The reduced pressure backflow assembly can be used for high hazard situations under backpressure only. Under normal conditions, the second check valve should never close.

- A. True      B. False

61. According to the text, if the second check valve fails or becomes fouled and backflow into the reduced pressure zone occurs, the relief port vents the backflow to atmosphere.

- A. True      B. False

62. According to the text, the reduced pressure zone port opens anytime pressure in the zone comes within 2 psi of the supply pressure.

- A. True      B. False

### **Confined Space Entry Program**

#### **Purpose**

63. The Confined Space Entry Program is provided to protect authorized employees that will enter confined spaces and may be exposed to hazardous atmosphere, engulfment in materials, conditions that may trap or asphyxiate due to converging or sloping walls, or contains any other safety or health hazards.

- A. True      B. False

#### **Scope**

64. According to the text, you are required to recognize this term associated with confined spaces.

- |                                   |  |
|-----------------------------------|--|
| A. An internal configuration      | D. Dangers and hazards                     |
| B. Hazardous atmosphere           | E. Atmospheric factors and physical agents |
| C. Permit-Required Confined Space | F. None of the Above                       |

#### **Definitions**

65. Is large enough or so configured that an employee can?

- |                                  |   |
|----------------------------------|---|
| A. Engulfing an entrant          | D. Recognized serious safety or health hazard |
| B. Bodily enter and perform work | E. Continuous employee occupancy              |
| C. An internal configuration     | F. None of the Above                          |

66. Is not designed for?

- |                              |   |
|------------------------------|---|
| A. Engulfing an entrant      | D. Recognized serious safety or health hazard |
| B. Hazardous atmospheres     | E. Continuous employee occupancy              |
| C. An internal configuration | F. None of the Above                          |

67. Permit required confined space (permit space), is a confined space that has one or more of the following characteristics: Contains or has a potential to contain a?

- A. An internal configuration
- B. Hazardous atmosphere
- C. Permit-Required Confined Space
- D. Entry or exit
- E. Atmospheric factors and physical agents
- F. None of the Above

68. Has limited or restricted means for entry or exit (i.e. tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have?

- A. An internal configuration
- B. Hazardous atmosphere
- C. Limited means of entry
- D. Entry or exit
- E. Atmospheric factors and physical agents
- F. None of the Above

69. Contains a material that has the?

- A. Engulfing an entrant
- B. Hazardous atmospheres
- C. Potential for engulfing an entrant
- D. Recognized serious safety or health hazard
- E. Continuous employee occupancy
- F. None of the Above

70. Has an internal configuration such that \_\_\_\_\_ could be trapped or asphyxiated by inwardly covering walls or by a floor that slopes downward and tapers to a smaller cross-section.

- A. An internal configuration
- B. Hazardous atmosphere
- C. Permit-Required Confined Space
- D. An entrant
- E. Atmospheric factors and physical agents
- F. None of the Above

71. Contains any other recognized serious safety or?

- A. Engulfing an entrant
- B. Hazardous atmospheres
- C. An internal configuration
- D. Health hazard
- E. Continuous employee occupancy
- F. None of the Above

72. Which of the following terms -will be marked "Confined Space - Entry Permit Required"?

- A. An internal configuration
- B. Hazardous atmosphere
- C. Permit-Required Confined Space
- D. Entry or exit
- E. Atmospheric factors and physical agents
- F. None of the Above

### **Confined Space Hazards**

73. Fatalities and injuries constantly occur among construction workers who, during the course of their jobs, are required to enter \_\_\_\_\_.

- A. An internal configuration
- B. Hazardous atmosphere
- C. Ventilation ducts
- D. Entry or exit
- E. Confined spaces
- F. None of the Above

74. Throughout the construction jobsite, contractors and workers encounter both inherent and \_\_\_\_\_ within confined workspaces.

- A. An internal configuration
- B. Hazardous atmosphere
- C. Permit-Required Confined Space
- D. Induced hazards
- E. Atmospheric factors and physical agents
- F. None of the Above

### **Inherent Hazards**

75. Which of the following terms - such as electrical, thermal, chemical, mechanical, etc., are associated with specific types of equipment and the interactions among them?

- A. Inherent hazards
- B. Hazardous atmospheres
- C. An internal configuration
- D. Recognized serious safety or health hazard
- E. Continuous employee occupancy
- F. None of the Above

76. Inherent Hazards include high voltage (shock or corona discharge and the resulting burns), radiation generated by equipment, \_\_\_\_\_, omission of protective features, high or low temperatures, high noise levels, and high-pressure vessels and lines.

- A. An internal configuration
- B. Hazardous atmosphere
- C. Permit-Required Confined Space
- D. Defective design
- E. Atmospheric factors and physical agents
- F. None of the Above

77. Inherent hazards usually cannot be eliminated without degrading the system or equipment, or without making them inoperative. An emphasis must be placed on?

- A. Hazard control methods
- B. Hazardous atmospheres
- C. An internal configuration
- D. Recognized serious safety or health hazard
- E. Continuous employee occupancy
- F. None of the Above

### **Induced Hazards**

78. Induced Hazards are: omission of protective features, physical arrangements that may cause unintentional worker contact with electrical energy sources, oxygen-deficient atmospheres created at the bottom of pits or shafts, lack of safety factors in structural strength, and?

- A. Common confined space
- B. Hazard
- C. Vaults
- D. An oxygen-deficient atmosphere
- E. Flammable atmospheres
- F. None of the Above

79. Which of the following terms - arise, and are induced from, a multitude of incorrect decisions and actions that occur during the actual construction process?

- A. Induced hazards
- B. Below-grade location
- C. Vibration
- D. Build-up of explosive gases
- E. Oxygen-deficient atmospheres
- F. None of the Above

### **Typical Examples of Confined Workspaces**

80. An example of confined workspaces in construction which contain?

- A. Purging agents
- B. Below-grade location
- C. Vibration
- D. Both inherent and induced hazards
- E. Oxygen-deficient atmospheres
- F. None of the Above

### **Condenser Pits**

81. According to the text, a common confined space found in the construction of nuclear power plants is the condenser pit, because of their large size, they are often overlooked as?

- A. Common confined spaces
- B. Hazards
- C. Vaults
- D. An oxygen-deficient atmospheres
- E. Potentially hazardous confined spaces
- F. None of the Above

82. Below-grade areas create large containment areas for the accumulation of toxic fumes, gases, and so forth, or for the creation of \_\_\_\_\_ when purging with argon, Freon, and other inert gases.

- A. Purging agents
- B. Below-grade location
- C. Vibration
- D. Build-up of explosive gases
- E. Oxygen-deficient atmospheres
- F. None of the Above

### Manholes

83. Which of the following terms - are associated with manholes?

- A. Nitrogen purge or dry air
- B. Collection places
- C. A variety of hazards
- D. Problem with the pumps
- E. Oxygen deficiency exists
- F. None of the Above

### Oxygen-Deficient Atmosphere

84. One of the major problems confronting construction workers while working in vaults is the ever-present possibility of?

- A. Common confined space
- B. Hazard
- C. Vaults
- D. An oxygen-deficient atmosphere
- E. Ground-fault circuit interrupters or low-voltage systems
- F. None of the Above

### Explosive or Toxic Gases, Vapors, or Fumes

85. Which of the following terms - produce toxic fumes that are confined in the limited atmosphere?

- A. Purging agents
- B. Below-grade location
- C. Welding and soldering
- D. Build-up of explosive gases
- E. Oxygen-deficient atmospheres
- F. None of the Above

### Hydraulics

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

- A. True
- B. False

87. 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

88. 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

89. 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

90. \_\_\_\_\_ 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

91. 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

92. 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

93. \_\_\_\_\_ includes the study of liquids in motion and 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

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

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

95. \_\_\_\_\_ 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

96. Which of the following terms is stated that in 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

97. 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**

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

- A. True
- B. False



99. Which of the following terms is the layer 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

100. 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

101. \_\_\_\_\_ at sea level is approximately 14.7 psi?

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

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

- A. True
- B. False

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

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

104. Pressures under water differ from those under air only because the weight of the water must be added to the \_\_\_\_\_.

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

105. \_\_\_\_\_ can be measured by any of several methods, one method is the mercury column barometer?

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

106. 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

107. Which of the following terms can be measured with the aneroid barometer?

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

108. The atmospheric pressure does not vary uniformly with?

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

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

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

### **Barometric Loop**

110. 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

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

- A. True
- B. False

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

- A. True
- B. False

113. 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

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

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

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

- A. True
- B. False

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

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

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

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

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

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

119. 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

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

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

### Pressure

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

- A. True
- B. False

122. Both air and water are considered to be \_\_\_\_\_.

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

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

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

124. \_\_\_\_\_ 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

125. 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

126. The coefficient of viscosity is the ratio of \_\_\_\_\_ to the velocity gradient.

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

127. 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

128. 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

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

130. 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

131. Therefore, 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

132. 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
- B. Gravitational body force
- C. Pressure
- D. Displaced fluid
- E. Gravitation
- F. None of the Above

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

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

134. When the barometric equation, for when this equation is integrated, we find the variation of pressure with?

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

### Free Surface Perpendicular to Gravity

135. 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

136. Which of the following terms is a practice that is conveniently used to measure 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

137. \_\_\_\_\_ 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

138. 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

139. 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

140. It is impossible to produce a partial vacuum.
- A. True
  - B. False

141. 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

142. 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

143. 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

144. When a siphon goes below the free water levels, it is called an \_\_\_\_\_.

- A. Epihydro      D. Hydrostat  
B. Water bearer      E. Inverted siphon  
C. Siphon      F. None of the Above

145. \_\_\_\_\_ can be made by filling the tube, closing the ends, and then putting the ends under the surface on both sides?

- A. Epihydro      D. Hydrostat  
B. Water bearer      E. Inverted siphon  
C. Siphon      F. None of the Above

146. \_\_\_\_\_ is 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

147. 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

148. 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

149. The name is Greek for the tube and is another application of pressure is the?

- A. Epihydro      D. Hydrostat  
B. Water bearer      E. Hydraulic machine  
C. Siphon      F. None of the Above

### Pressure and Force

150. 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

151. Water pressure determines the flow of water from the tap.

- A. True      B. False

152. \_\_\_\_\_ 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

153. \_\_\_\_\_ means a total push or pull. It is the push or pull exerted against the total area of a particular surface.  
A. Absolute pressure      D. Volume  
B. Pressure                      E. Force  
C. Fluid(s)                      F. None of the Above

154. Which of the following terms means the amount of push or pull applied to each unit area of the surface?  
A. Absolute pressure      D. Volume  
B. Pressure                      E. Force  
C. Fluid(s)                      F. None of the Above

155. Which of the following terms maybe exerted in one direction, in several directions, or in all directions?  
A. Absolute pressure      D. Volume  
B. Pressure                      E. Force  
C. Fluid(s)                      F. None of the Above

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

156. 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**

157. 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

158. 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

159. 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

160. \_\_\_\_\_ 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

161. 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

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. True
- B. False

165. 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, by his brother-in-law?

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

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

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

167. 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

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

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

### **Meteorology**

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

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



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

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

### Pascal's Law

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

- A. True
- B. False

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

- A. True
- B. False

173. 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

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

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

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

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

176. 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
- D. Column is tripled
- E. Is equal
- F. None of the Above

177. The indicated pressure is doubled, when the?

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

178. The pressure at any depth in this 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
- B. Pressure will be less
- C. Pressure of a liquid
- D. Liquid is equal to the weight
- E. Is equal
- F. None of the Above

179. \_\_\_\_\_ produces the pressure 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

180. 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

181. Static pressure exists in addition to Gravity and may be present at the same time.

- A. True
- B. False

182. 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

183. 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

184. 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

185. 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

186. \_\_\_\_\_ 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

187. 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

188. 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

189. 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 (fps) or feet per minute (fpm).

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

190. \_\_\_\_\_ 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

191. 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**

192. 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

193. 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

194. Which of the following terms explains the difference between the outside and inside, causing 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

195. 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

196. 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

197. 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**

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

- A. True
- B. False

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

- A. True
- B. False

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

- A. True
- B. False