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48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL $40.00

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Onsite Installer Onsite SP Installer Other _____

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1.	A B C D E	41.	A B C D E	81.	A B C D E	121.	A B C D E
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Pumping Principles CEU Course

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Pumping Principles CEU Training Course Assignment

You will have 90 days to complete this assignment and submit it to TLC. Please include the Registration Page, Answer Key and Customer Survey. You can find help on line on the Assignment Page, under Course Assistance.

Multiple Choice Exam *Please utilize the Answer key in the front of this section.*

1. _____ is a branch of engineering concerned mainly with moving liquids.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

2. Hydraulics is applied commonly to the study of the mechanical properties of water, other _____, and even gases when the effects of compressibility are small.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

3. Hydraulics can be divided into two areas, _____ and hydrokinetics.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

4. 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. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

5. Hydraulics includes the manner in which _____ act in tanks and pipes, deals with their properties, and explores ways to take advantage of these properties.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

6. _____, the consideration of liquids at rest, involves problems of buoyancy and flotation, pressure on dams and submerged devices, and hydraulic presses.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

7. The relative incompressibility of _____ is one of its basic principles.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

8. _____, 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. Hydrokinetics
B. Hydrodynamics
C. Hydraulics
D. Engineering
E. Liquids

9. _____ is about the pressures exerted by a fluid at rest. Any fluid is meant, not just water.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Engineering
E. Liquids

10. Hydrostatics is an excellent example of _____, one that can be understood easily and completely from a very few fundamentals, and in which the predictions agree closely.
A. Experiment
B. Atmosphere
C. Geology
D. Column
E. None of the Above

11. The definition of a fluid deserves careful consideration. Although time is not a factor in hydrostatics, it enters in the approach to hydrostatic equilibrium. It is usually stated that a fluid is a substance that cannot resist a _____, so that pressures are normal to confining surfaces.
A. Experiment
B. Atmosphere
C. Geology
D. Column
E. Shearing stress **Please use the Answer Key in front.**

12. Geology has now shown us clearly that there are substances which can resist _____ forces over short time intervals, and appear to be typical solids, but which flow like liquids over long time intervals.
A. Experiment.
B. Atmosphere
C. Geology
D. Column
E. Shearing

13. The atmosphere is the entire mass of air that surrounds the earth. While it 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. Experiment
B. Atmosphere
C. Geology
D. Column
E. None of the Above

14. If a _____ of air 1-inch square extending all the way to the "**top**" of the atmosphere could be weighed, this column of air would weigh approximately 14.7 pounds at sea level.
A. Experiment
B. Atmosphere
C. Geology
D. Column
E. None of the Above

15. _____ pressure at sea level is approximately 14.7 psi.
A. Experiment
B. Atmospheric
C. Geology
D. Column
E. None of the Above

16. As one _____, the atmospheric pressure decreases by approximately 1.0 psi for every 2,343 feet.
A. Experiment
B. Atmosphere
C. Geology
D. Column
E. None of the Above

17. Below sea level, in excavations and depressions, atmospheric pressure _____.
A. Pressure
B. Weight
C. Increases
D. Mercury
E. None of the Above
If you need any assistance, utilize the Search function in Adobe Acrobat.

18. _____ under water differ from those under air only because the weight of the water must be added to the pressure of the air.
A. Pressures
B. Weight
C. Increases
D. Mercury
E. None of the Above

19. Atmospheric pressure can be measured by any of several methods. The common laboratory method uses the mercury column barometer. The height of the _____column serves as an indicator of atmospheric pressure.
A. Pressure
B. Weight
C. Increases
D. Mercury
E. None of the Above

20. 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. The 30-inch column is used as a _____.
A. Pressure
B. Weight
C. Increases
D. Mercury
E. None of the Above

21. Another device used to measure atmospheric _____ is the aneroid barometer.
A. Pressure
B. Weight
C. Increases
D. Mercury
E. None of the Above

22. The aneroid barometer uses the change in shape of an evacuated metal cell to measure variations in atmospheric _____.
A. Pressure
B. Weight
C. Increases
D. Mercury
E. None of the Above

23. The atmospheric pressure does _____ with altitude. It changes very rapid.
A. Pressure
B. Weight
C. Increases
D. Mercury
E. None of the Above

24. The barometric loop consists of a continuous section of supply piping that abruptly rises to a height of approximately 35 feet and then returns back down to the originating level. It is a loop in the piping system that effectively protects against _____.
A. Absolute scale
B. Barometric loops
C. Back-pressure
D. Backsiphonage
E. None of the Above

25. The barometric loop may not be used to protect against _____.
A. Absolute scale
B. Barometric loops
C. Back-pressure
D. Backsiphonage
E. None of the Above

26. Its operation, in the protection against backsiphonage, is based upon the _____ that a water column, at sea level pressure, will not rise above 33.9 feet.
A. Absolute scale
B. Barometric loops
C. Back-pressure
D. Backsiphonage
E. None of the Above

27. In general, _____ are locally fabricated, and are 35 feet high.
A. Absolute scale
B. Barometric loops
C. Back-pressure
D. Backsiphonage
E. None of the Above

28. Pressure may be referred to using an _____, pounds per square inch absolute (**psia**), or gauge scale, (**psiag**).
A. Absolute scale
B. Barometric loops
C. Back-pressure
D. Backsiphonage
E. None of the Above

29. Absolute pressure and gage pressure are related. _____ pressure is equal to gauge pressure plus the atmospheric pressure.
A. Absolute
B. Barometric loops
C. Back-pressure
D. Backsiphonage
E. None of the Above

30. The speed at which the magnetic field rotates is called the motor's synchronous speed. It is expressed in revolutions per minute. For a motor that operates on an electric power system having a frequency of 60Hz, the maximum synchronous speed is 3,600 rpm, or 60 revolutions per second. In other words, because the electric current changes its flow direction 60 times a second, the rotor can rotate 60 times per second. This speed is achieved by?
A. The Starting Current
B. Squirrel cage
C. A two-pole motor
D. A three phase stator
E. All of the above

31. _____ is a condition in which the pressure in the distribution system is less than atmospheric pressure. In other words, something is "sucked" into the system because the main is under a vacuum.
A. Backsiphonage
B. Backpressure

32. Float mechanisms, diaphragm elements, bubbler tubes, and direct electronic sensors are?
A. Types of valves
B. Methods of telemetry
C. Common types of level sensors
D. Out dated methods of measuring flows
E. All of the above

33. When a pump operates under suction, the impeller inlet is actually operating in a vacuum. Air will enter the water stream along the shaft if the packing does not provide an effective seal. It may be impossible to tighten the packing sufficiently to prevent air from entering without causing excessive heat and wear on the packing and shaft or shaft sleeve. To solve this problem, a _____ is placed in the Stuffing Box.
A. Lantern Ring
B. Packing Gland
C. Sanitary seal
D. Wye
E. None of the above

34. If the pump must operate under high suction head, the suction pressure itself will compress the packing rings regardless of the operator's care. Packing will then require frequent replacement. Most manufactures recommend using _____ for low-suction head conditions as well.
A. Mechanical Seals
B. Graphite
C. Vibration devices
D. Flow controls
E. All of the above

35. In general, any _____pump can be designed with a multistage configuration. Each stage requires an additional _____ and casing chamber in order to develop increased pressure, which adds to the pressure developed by the preceding stage.
A. Submersible, Diffuser
B. Centrifugal, Impeller
C. Displacement, Volute
D. Centrifugal, Foot valve

36. The axial-flow pump is often referred to as a _____.
A. Propeller Pump
B. Submersible Pump
C. Hydraulic pump
D. None of the above

37. In all centrifugal pumps, there must be a flow restriction between the _____ discharge and _____ areas that will prevent excessive circulation of water between the two parts.
A. Wear ring & Foot valve
B. Impeller & Suction
C. Lantern Ring & Shaft Sleeve
D. Packing rings & Shaft

38. This type of valve is designed to, 1. Prevent overflows from the storage tank or reservoir, or 2. Maintain a constant water level as long as water pressure in the distribution system is adequate.
A. Double Check
B. PVB
C. Air Relief
D. Ball
E. Altitude-Control Valve

39. The mechanical seal is designed so that it can be hydraulically balanced. The result is that the wearing force between the machined surfaces does not vary regardless of the suction head. Most seals have an operating life of _____.
A. 5,000 to 20,000 hours
B. 50,000
C. 75,000
D. 1 million hours

40. Which of the following is a correct statement concerning a single phase motor?
A. If it is a split-phase motor, the motor will not have windings.
B. A repulsion-induction motor is very simple and less expensive than other single phase motors.
C. Will have a capacitor start motor has a high starting torque and a high starting current.
D. All of the above
E. None of the above

41. A chlorine demand test from a well water sample produces a result of 1.2 mg/L. The water supplier would like to maintain a free chlorine residual of 0.2 mg/L throughout the system. What should be the chlorine dose in mg/L from either a chlorinator or a hypochlorinator?
A. 1.2
B. 0.2
C. 1.0
D. 1.4

42. The vacuum created by a chlorine ejector moves through this device. This device prevents water from back feeding or entering the vacuum-regulator portion of the chlorinator.
A. Rate valve
B. The ejector
C. Interconnection manifold
D. Check valve assembly
E. Rotameter

43. A water storage facility should be able to provide water for the _____ and _____ demands.
A. Typical, Fire
B. Average, Peak
C. Fire, Peak
D. Maximum, Minimum
E. CMOM, CAFO

44. What is the peak demand?
A. The maximum momentary load placed on a water treatment plant, pumping station or distribution system.
B. The total demand for water during the period of time divided by the number of days in that time period.
C. None of the above

45. Surge tanks are used to control?
A. Water Hammer
B. Chlorine Demand
C. Backpressure
D. Backwash
E. CAFO

46. On most kilowatt meters, the current kilowatt load is indicated by?
A. The Primary or Binder dial
B. Current load dial
C. Disk revolutions
D. None of the above

47. This special type of check valve is located at the bottom end of the suction on a pump. This valve opens when the pump operates to allow water to enter the suction pipe but closes when the pump shuts off to prevent water from flowing out of the suction pipe?
A. Prime Valve
B. Foot
C. Impeller

48. Distribution system water quality can be adversely affected by improperly constructed or poorly located blowoffs of vacuum/air relief valves. Air relief valves in the distribution system lines must be placed in locations that cannot be flooded. This is to prevent water contamination. What customer complaint is sometimes solved by the installation of air relief valves?
A. Taste and odors
B. Milky water
C. MIB
D. Constipation

49. Which of the following pumps is consisting of an impeller fixed on a rotating shaft that is enclosed in a casing, and having an inlet and discharge connection? As the rotating impeller spins the liquid around, force builds up enough pressure to force the water through the discharge outlet?
A. Booster
B. Centrifugal
C. Submersible
D. Rotator

50. What is a limitation of hydropneumatic tanks?
A. Do not provide much storage during average demands
B. Do not provide much storage to meet peak demands during power outages
C. Very limited time to do repairs on equipment
D. Both B & C

51. Why would a pump engineer design a system that would use multiple pumps for a parallel operation?
A. To provide for a fluctuating demand
B. To provide an increased discharge head
C. To reduce the friction coefficient on a larger pump for greater efficiency
D. All of the above

52. When the superintendent is inspecting the plans for a new ground water storage tank, the superintendent should pay attention to the inlet and outlet of this tank. What design factor should be noticed?
A. The outlet and inlet should be on opposite sides of the tank
B. The inlet must be twice the size of the outlet
C. The outlet must be twice the size of the inlet
D. The outlet and inlet should be on the top
E. CMOM

53. Water quality in a storage facility could degrade due to excessive water age caused by low demands for water and short-circuiting within the distribution storage reservoir. Which of the following are not other reasons for water quality degradation?
A. Sampling program
B. Poor design
C. Inadequate maintenance
D. Improperly applied coating and linings

54. Transmitting equipment requires installation where temperature will not exceed?
A. 100 degrees F.
B. 100 degrees C.
C. 130 degrees C.
D. 130 degrees F.

55. A diaphragm element being used as a level sensor would be used in conjunction with?
A. Pressure Sensor
B. Manometer
C. Rotometer
D. Redwood plug
E. HTH

56. Inspection of magnetic flow meter instrumentation should include?
A. Checking EMF on the hemisphere transducer
B. Checking for corrosion or insulation deterioration
C. Placing a bucket of water for your feet
D. Polarity multiplexing

57. The most frequent problem that affects a liquid pressure-sensing device is?
A. Air accumulation at the sensor
B. Greenhouse effect
C. Freezing
D. Sensing solenoid failure
E. CAFO

58. Which of the following is not a pressure sensing device?
A. Helical Sensor
B. Bourdon Tube
C. Campos Gauge
D. Bellows Sensor

59. Absolute pressure is the _____.
A. Absolute
B. Gauge
C. Volume
D. Incompressible
E. None of the Above

60. 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 _____ pressure would be equal to 14.7 psi, which is the atmospheric pressure.
A. Absolute
B. Gauge
C. Volume
D. Incompressible
E. None of the Above

61. Water is _____, while air is very compressible, but both are fluids.
A. Absolute
B. Gauge
C. Volume
D. Incompressible
E. None of the Above

62. Water has a definite _____; air does not.
A. Absolute
B. Gauge
C. Volume
D. Incompressible
E. None of the Above

63. Water and air have low _____; 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
B. Gauge
C. Volume
D. Incompressible
E. None of the Above

64. A fluid, therefore, is a substance that cannot exert any _____ tangential to a boundary.
A. Absolute
B. Gauge
C. Volume
D. Incompressible
E. None of the Above

65. Any force that it exerts on a boundary must be normal to the boundary. Such a force is proportional to the area on which it is exerted, and is called a _____.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Pressure
E. None of the Above

66. On earth, fluids are also subject to the force of _____.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

67. The density of water is about 1 g/cm3, or its _____ is 62.4 pcf.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

68. 33.9 ft of water is the maximum height to which water can be raised by a suction pump, or, more correctly, can be supported by _____.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

69. When _____ acts, the liquid assumes a free surface perpendicular to gravity, which can be proved by Thomson's method.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure

70. This definition of the standard _____was established by Regnault in the mid-19th century. In Britain, 30 in Hg (inches of mercury) had been used previously.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

71. As a practical matter, it is convenient to measure pressure differences by measuring the height of liquid columns, a practice known as _____.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

72. The barometer is a familiar example of this, and atmospheric pressures are traditionally given in terms of the length of a _____.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

73. To make a barometer, the barometric tube, closed at one end, is filled with mercury and then _____ and placed in a mercury reservoir.
A. Barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

74. An _____ uses a partially evacuated chamber of thin metal that expands and contracts according to the external pressure. This movement is communicated to a needle that revolves in a dial.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

75. The materials and construction in an aneroid barometer are arranged to give a low temperature _____.
A. Aneroid barometer
B. Specific weight
C. Gravity
D. Atmospheric pressure
E. None of the Above

76. The aneroid barometer instrument must be calibrated before use, and is usually arranged to read directly in _____.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

77. An aneroid barometer is much easier to use in field observations, such as in _____ surveys.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

78. An absolute pressure is referred to as a _____, while a gauge pressure is referred to as the atmospheric pressure at the moment.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

79. Negative gauge pressure is a (_____) vacuum.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

80. When a _____is stated to be so many inches, this means the pressure below the atmospheric pressure of about 30 in.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

81. A vacuum of 25 inches is the same thing as an _____ pressure of 5 inches (of mercury).
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

82. The term **vacuum** indicates that the absolute _____ is less than the atmospheric pressure and that the gauge pressure is negative.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

83. A complete or total vacuum would mean a _____ of 0 psia or –14.7 psig.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

84. Since it is impossible to produce a total vacuum, the term _____, will mean all degrees of partial vacuum.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

85. In a _____ vacuum, the pressure would range from slightly less than 14.7 psia (0 psig) to slightly greater than 0 psia (-14.7 psig).
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

86. Backsiphonage results from atmospheric pressure exerted on a liquid forcing it toward a supply system that is under a _____.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

87. The weight of a cubic foot of water is 62.4 pounds per square foot. The base can be subdivided into 144-square _____ with each subdivision being subjected to a pressure of 0.433 psig.
A. Gauge
B. Vacuum
C. Pressure
D. Partial
E. None of the Above

88. Pressures are very frequently stated in terms of the height of a fluid. If it is the same fluid whose pressure is being given, it is usually called "head," and the factor connecting the head and the pressure is the weight density ρg. In the English _____ system, weight density is in pounds per cubic inch or cubic foot.
A. Gauge
B. Vacuum
C. Pressure
D. Engineer's
E. None of the Above

A little math.

89. What would the static pressure be on a pressure gauge at the bottom of a 60 foot wide water tower that contained 180 feet of water?
A. 415
B. 78
C. 1501.2
D. 25.98
E. 10800

90. What would the static pressure be on a pressure gauge at the bottom of a 30 foot wide water tower that contained 180 feet of water?
A. 415
B. 78
C. 1501.2
D. 25.98
E. 10800

91. What would the static pressure be on a pressure gauge at the bottom of a 300 foot wide water tower that contained 10 feet of water?
A. 2.31
B. 23.10
C. 43
D. 4.33
E. None of the above

92. A fire hydrant has a static pressure of 86 PSI, how much Head is stored in the storage tank?
A. Not enough information.
B. 37.22
C. 198.66
D. 643.28

93. There is 35 feet of water in a storage tank. The tank was recently pressure cleaned and is located at the top of a hill. What should the natural pressure be on the bottom of this cleaned tank?
A. Not enough information.
B. Too much information but the answer is 15 PSI
C. Too much information but the answer is 283 PSI

94. In studying fluids _____, we are concerned with the transmission of force and the factors which affect the forces in liquids. Additionally, pressure in and on liquids and factors affecting pressure are of great importance.
A. Force
B. Pressure
C. Pull
D. Push
E. None of the Above

95. Pressure is the force that pushes water through pipes. Water pressure determines the flow of water from the tap. If _____ is not sufficient then the flow can reduce to a trickle and it will take a long time to fill a kettle or a cistern.
A. Force
B. Pressure
C. Pull
D. Push
E. None of the Above

96. The terms **force** and _____ are used extensively in the study of fluid power. It is essential that we distinguish between the terms.
A. Force
B. Pressure
C. Pull
D. Push
E. None of the Above

97. Force means a total push or _____. It is the push or pull exerted against the total area of a particular surface and is expressed in pounds or grams.
A. Force
B. Pressure
C. Pull
D. Push
E. None of the Above

98. Pressure means the amount of _____ or pull (force) applied to each unit area of the surface and is expressed in pounds per square inch (lb/in2) or grams per square centimeter (gm/cm2).
A. Force
B. Pressure
C. Pull
D. Push
E. None of the Above

99. Pressure maybe _____ in one direction, in several directions, or in all directions.
A. Force
B. Pressure
C. Pull
D. Push
E. None of the Above

100. A formula is used in computing force, pressure, and area in fluid power systems. In this formula, P refers to pressure, F indicates force, and A represents area. _____ equals pressure times area.
A. Force
B. Pressure
C. Pull
D. Push

Some History

101. Although the modern development of hydraulics is comparatively recent, the ancients were familiar with many _____and their applications.
A. Submerged bodies
B. Fundamental law
C. Hydraulic principles
D. Domestic purposes
E. Discharge of water

102. The Egyptians and the ancient people of Persia, India, and China conveyed water along channels for irrigation and _____, using dams and sluice gates to control the flow.
A. Submerged bodies
B. Fundamental law
C. Hydraulic principles
D. Domestic purposes
E. Discharge of water

103. The ancient Cretans had an elaborate plumbing system. Archimedes studied the laws of floating and _____. The Romans constructed aqueducts to carry water to their cities.
A. Submerged bodies
B. Fundamental law
C. Hydraulic principles
D. Domestic purposes
E. Discharge of water

104. Beginning near the end of the seventeenth century, Italian physicist, Evangelista Torricelle, French physicist, Edme Mariotte, and later, Daniel Bernoulli conducted experiments to study the elements of force in the _____ through small openings in the sides of tanks and through short pipes.
A. Submerged bodies
B. Fundamental law
C. Hydraulic principles
D. Domestic purposes
E. Discharge of water

105. Blaise Pascal, a French scientist, discovered the _____for the science of hydraulics.
A. Submerged bodies
B. Fundamental law
C. Hydraulic principles
D. Domestic purposes
E. Discharge of water

106. _____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
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces

107. For _____to be made effective for practical applications, it was necessary to have a piston that "**fit exactly**." It was not until the latter part of the eighteenth century that methods were found to make these snugly fitted parts required in hydraulic systems.
A. Pascal's law
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

108. _____ was accomplished by the invention of machines that were used to cut and shape the necessary closely fitted parts and, particularly, by the development of gaskets and packings.
A. Pascal's law
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

109. Since that time, _____ such as valves, pumps, actuating cylinders, and motors have been developed and refined to make hydraulics one of the leading methods of transmitting power.
A. Pascal's law
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

110. Evangelista Torricelli (1608-1647), was _____'s student and secretary,
A. Pascal's law
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

111. _____a member of the Florentine Academy of Experiments, invented the mercury barometer in 1643, and brought the weight of the atmosphere to light.
A. Pascal's law
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

112. The mercury column was held up by the pressure of the atmosphere, not by horror vacui as _____ had supposed.
A. Aristotle
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

113. Torricelli's early death was a blow to science, but his ideas were furthered by _____ (1623-1662).
A. Pascal
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

114. _____ had a barometer carried up the 1465 m high Puy de Dôme, an extinct volcano in the Auvergne just west of his home of Clermont-Ferrand in 1648 by Périer, his brother-in-law. Pascal's experimentum crucis is one of the triumphs of early modern science.
A. Pascal
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

115. The Puy de Dôme is not the highest peak in the Massif Central--the Puy de Sancy, at 1866 m is, but it was the closest. _____is now the centre of the French pneumatics industry.
A. Pascal
B. Evangelista Torricelli
C. Galileo
D. Experimentum cruces
E. None of the Above

116. The remarkable _____ (1602-1686), Burgomeister of Magdeburg, Saxony, took up the cause, making the first vacuum pump, which he used in vivid demonstrations of the pressure of the atmosphere to the Imperial Diet at Regensburg in 1654.
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's
E. None of the Above Famous Scientists

117. Famously, he evacuated a sphere consisting of two well-fitting hemispheres about a foot in diameter, and showed that 16 horses, 8 on each side, could not pull them apart. An original vacuum pump and hemispheres from 1663.
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's
E. None of the Above Famous Scientists

118. He also showed that air had weight, and how much force it did require to separate evacuated hemispheres.
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's
E. None of the Above Famous Scientists

119. In England, Robert Hooke (1635-1703) made a vacuum pump for _____ (1627-1691). Christian Huygens (1629-1695) became interested in a visit to London in 1661 and had a vacuum pump built for him.
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's
E. None of the Above Famous Scientists

120. By this time, _____ doctrine had triumphed over the Church's support for horror vacui. This was one of the first victories for rational physics over the illusions of experience, and is well worth consideration.
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's
E. None of the Above Famous Scientists

121. _____ demonstrated that the siphon worked by atmospheric pressure, not by horror vacui.
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's
E. None of the Above Famous Scientists

122. The mm of mercury is sometimes called a torr after Torricelli, and _____also has been honored by a unit of pressure, a newton per square meter or 10 dyne/cm2
A. Pascal
B. Otto von Guericke
C. Robert Boyle
D. Torricelli's

These questions will come from the Hydraulic Glossary

123. _____ The Law of Conservation of Mass states that mass can be neither created nor destroyed. Using the Mass Conservation Law on a **steady flow** process - flow where the flow rates don't change over time - through a control volume where the stored mass in the control volume doesn't change - implements that inflow equals outflow.
A. Conservation laws
B. Euler Equations
C. Equation of Mechanical Energy
D. Equation of Continuity
E. The Bernoulli Equation

124. _____ is a statement of the first law of thermodynamics. The energy equation involves energy, heat transfer and work.
A. Conservation laws
B. Euler Equations
C. Equation of Mechanical Energy
D. Equation of Continuity
E. The Bernoulli Equation

125. With certain limitations the mechanical energy equation can be compared to the _____and transferred to the Mechanical Energy Equation in Terms of Energy per Unit Mass.
A. Conservation laws
B. Euler Equations
C. Equation of Mechanical Energy
D. Equation of Continuity
E. The Bernoulli Equation

126. The _____describes the behavior of gravitational, electric, and fluid potentials.
A. Conservation laws
B. Euler Equations
C. Darcy-Weisbach Equation
D. Laplace Equations
E. The Bernoulli Equation

127. The _____- For a perfect or ideal gas the change in density is directly related to the change in temperature and pressure as expressed in the Ideal Gas Law.
A. Mechanical Energy Equation
B. Pressure
C. Navier-Stokes Equations
D. Euler Equations
E. Ideal Gas Law

128. The motion of a non-turbulent, Newtonian fluid is governed by the _____. The equation can be used to model turbulent flow, where the fluid parameters are interpreted as time-averaged values.
A. Mechanical Energy Equation
B. Pressure
C. Navier-Stokes Equations
D. Euler Equations
E. Ideal Gas Law

129. _____ - A statement of the conservation of energy in a form useful for solving problems involving fluids. For a non-viscous, incompressible fluid in steady flow, the sum of pressure, potential and kinetic energies per unit volume is constant at any point.
A. Conservation laws
B. Euler Equations
C. Equation of Mechanical Energy
D. Equation of Continuity
E. The Bernoulli Equation

130. The _____ states that particular measurable properties of an isolated physical system does not change as the system evolves.
A. Conservation laws
B. Euler Equations
C. Equation of Mechanical Energy
D. Equation of Continuity
E. The Bernoulli Equation

131. _____Pressure Loss and Head Loss due to Friction in Ducts and Tubes - Major loss - head loss or pressure loss - due to friction in pipes and ducts.
A. Conservation laws
B. Euler Equations
C. Darcy-Weisbach Equation
D. Laplace Equations
E. The Bernoulli Equation

132. In fluid dynamics, the _____govern the motion of a compressible, inviscid fluid. They correspond to the Navier-Stokes equations with zero viscosity, although they are usually written in the form shown here because this emphasizes the fact that they directly represent conservation of mass, momentum, and energy.
A. Conservation laws
B. Euler Equations
C. Equation of Mechanical Energy
D. Equation of Continuity
E. The Bernoulli Equation

133. The _____- The mechanical energy equation in Terms of Energy per Unit Mass, in Terms of Energy per Unit Volume and in Terms of Energy per Unit Weight involves Heads.
A. Mechanical Energy Equation
B. Pressure
C. Navier-Stokes Equations
D. Euler Equations
E. Ideal Gas Law

134. Static Pressure and Pressure Head in a Fluid - _____ and _____ head in a static fluid.
A. Mechanical Energy Equation
B. Pressure
C. Navier-Stokes Equations
D. Euler Equations
E. Ideal Gas Law

135. In fluid dynamics, the _____govern the motion of a compressible, inviscid fluid. They correspond to the Navier-Stokes equations with zero viscosity, although they are usually written in the form shown here because this emphasizes the fact that they directly represent conservation of mass, momentum, and energy.
A. Mechanical Energy Equation
B. Pressure
C. Navier-Stokes Equations
D. Euler Equations
E. Ideal Gas Law

136. _____**:** If the compression or expansion takes place under constant temperature conditions - the process is called **isothermal.**
A. Contaminant
B. Compression and Expansion of Gases
C. Conservation Laws
D. Contamination
E. Isothermal

137. The _____states that particular measurable properties of an isolated physical system does not change as the system evolves: Conservation of energy (including mass). Fluid Mechanics and Conservation of Mass - The law of conservation of mass states that mass can neither be created or destroyed.
A. Contaminant
B. Compression and Expansion of Gases
C. Conservation Laws
D. Contamination
E. Isothermal

138. _____Any natural or man-made physical, chemical, biological, or radiological substance or matter in water, which is at a level that may have an adverse effect on public health, and which is known or anticipated to occur in public water systems.
A. Contaminant
B. Compression and Expansion of Gases
C. Conservation Laws
D. Contamination
E. Isothermal

139. _____To make something bad. To pollute or infect something. To reduce the quality of the potable (drinking) water and create an actual hazard to the water supply by poisoning or through spread of diseases.
A. Contaminant
B. Compression and Expansion of Gases
C. Conservation Laws
D. Contamination
E. Isothermal

140. Bernoulli's Equation describes the behavior of _____along a streamline.
A. Energy principle
B. Counterintuitive
C. Moving fluids
D. Qualitative behavior
E. Viscosity will decrease

141. The Bernoulli Equation can be considered to be a statement of the conservation of _____appropriate for flowing fluids.
A. Energy principle
B. Counterintuitive
C. Moving fluids
D. Qualitative behavior
E. Viscosity will decrease

142. The _____that is usually labeled with the term "**Bernoulli effect**" is the lowering of fluid pressure in regions where the flow velocity is increased.
A. Energy principle
B. Counterintuitive
C. Moving fluids
D. Qualitative behavior
E. Viscosity will decrease

143. This lowering of pressure in a constriction of a flow path may seem_____, but seems less so when you consider pressure to be energy density. In the high velocity flow through the constriction, kinetic energy must increase at the expense of pressure energy.
A. Energy principle
B. Counterintuitive
C. Moving fluids
D. Qualitative behavior
E. Viscosity will decrease

144. Bingham Plastic Fluids have a yield value which must be exceeded before it will start to flow like a fluid. From that point the _____ with increase of agitation. Toothpaste, mayonnaise and tomato catsup are examples of such products.
A. Energy principle
B. Counterintuitive
C. Moving fluids
D. Qualitative behavior
E. Viscosity will decrease

145. The boundary layer is the layer of fluid in the immediate vicinity of a _____.
A. Velocity
B. Bounding surface
C. Significant factor
D. Capillary action
E. Compressibility of fluids

146. **Bulk Modulus and Fluid Elasticity:** An introduction to and a definition of the Bulk Modulus Elasticity commonly used to characterize the _____
A. Velocity
B. Convex surface
C. Significant factor
D. Capillary action
E. Compressibility of fluids

147. **Capillarity:** Capillarity or _____is the ability of a narrow tube to draw a liquid upwards against the force of gravity.
A. Velocity
B. Convex surface
C. Significant factor
D. Capillary action
E. Compressibility of fluids

148. **Cauchy Number:** The Cauchy Number is a dimensionless value useful for analyzing fluid flow dynamics problems where compressibility is a _____.
A. Velocity
B. Convex surface
C. Significant factor
D. Capillary action
E. Compressibility of fluids

149. **Chezy Formula:** Conduits flow and mean _____.
A. Velocity
B. Convex surface
C. Significant factor
D. Capillary action
E. Compressibility of fluids

150. The Coanda Effect is the tendency of a stream of fluid to stay attached to a _____, rather than follow a straight line in its original direction.
A. Velocity
B. Convex surface
C. Significant factor
D. Capillary action

151. Under the wrong condition, _____ will reduce the components life time dramatically.
A. Suction
B. Cavities
C. Collapse
D. Fluid accelerates
E. Cavitation

152. _____ may occur when the local static pressure in a fluid reach a level below the vapor pressure of the liquid at the actual temperature.
A. Suction
B. Cavities
C. Collapse
D. Cavitation

153. According to the Bernoulli Equation this may happen when the _____ in a control valve or around a pump impeller.
A. Suction
B. Cavities
C. Collapse
D. Fluid accelerates
E. Cavitation

154. The vaporization itself does not cause the damage - the damage happens when the vapor almost immediately _____ after evaporation when the velocity is decreased and pressure increased.
A. Suction
B. Cavities
C. Collapse
D. Fluid accelerates

155. Cavitation means that _____ are forming in the liquid that we are pumping.
A. Suction
B. Cavities
C. Collapse
D. Fluid accelerates
E. Cavitation

156. When these cavities form at the suction of the pump several things happen all at once: We experience a loss in capacity. We can no longer build the same head (pressure). The efficiency drops. The cavities or bubbles will _____ when they pass into the higher regions of pressure causing noise, vibration, and damage to many of the components.
A. Suction
B. Cavities
C. Collapse
D. Fluid accelerates
E. Cavitation

157. The _____ form for five basic reasons and it is common practice to lump all of them into the general classification of cavitation.
A. Suction
B. Cavities
C. Collapse
D. Fluid accelerates
E. Cavitation

158. **Colebrook Equation:** The _____used to calculate pressure loss (or major loss) in ducts, tubes and pipes can be calculated with the Colebrook equation.
and can be used to calculate the friction coefficients in different kinds of fluid flows - air ventilation ducts, pipes and tubes with water or oil, compressed air and much more.
A. Physical separation
B. Undergo significant
C. Friction coefficients
D. Usually expressed
E. None of Above

159. **Compressible Flow:** We know that fluids are classified as Incompressible and Compressible fluids. Incompressible fluids do not undergo significant changes in density as they flow. In general, liquids are incompressible; water being an excellent example. In contrast compressible fluids do undergo _____.
A. Physical separation
B. Undergo significant
C. Friction coefficients
D. Usually expressed
E. None of Above

160. **Air Break:** An air break is a _____which may be a low inlet into the indirect waste receptor from the fixture, or device that is indirectly connected. You will most likely find an air break on waste fixtures or on non-potable lines. You should never allow an air break on an ice machine.
A. Physical separation
B. Space
C. Potential

161. **Air Gap Separation:** A _____space that is present between the discharge vessel and the receiving vessel, for an example, a kitchen faucet.
A. Physical separation
B. Undergo significant
C. Friction coefficients
D. Usually expressed
E. None of Above

162. **Absolute Pressure:** The pressure above zone absolute, i.e. the sum of atmospheric and gage pressure. In vacuum related work it is _____in millimeters of mercury. (mmHg).
A. Physical separation
B. Undergo significant
C. Friction coefficients
D. Usually expressed
E. None of Above

163. **Aerodynamics:** Aerodynamics is the study of the flow of gases. The Ideal Gas Law - For a perfect or ideal gas the _____is directly related to the change in temperature and pressure as expressed in the Ideal Gas Law.
A. Physical separation
B. Undergo significant
C. Friction coefficients
D. Usually expressed
E. None of Above

164. **Aeronautics:** Aeronautics is the mathematics and mechanics of _____, in particular airplanes.
A. Physical separation
B. Undergo significant
C. Friction coefficients
D. Usually expressed
E. None of Above

165. **Atmospheric Pressure:** Pressure exported by the atmosphere at any _____. (Sea level pressure is approximately 14.7 pounds per square inch absolute, 1 bar = 14.5psi.)
A. Undesirable effect
B. Specific location
C. Stop or prevent
D. Destructive manner
E. None of Above

166. **Backflow Prevention:** To _____ the occurrence of, the unnatural act of reversing the normal direction of the flow of liquid, gases, or solid substances back in to the public potable (drinking) water supply. See Cross-connection control.
A. Undesirable effect
B. Specific location
C. Stop or prevent
D. Destructive manner

167. **Backflow:** To reverse the natural and normal directional flow of a liquid, gases, or solid substances back in to the public potable (drinking) water supply. This is normally an _____.
A. Undesirable effect
B. Specific location
C. Stop or prevent
D. Destructive manner
E. None of Above

168. **Backsiphonage:** A liquid substance that is carried over a higher point. It is the method by which the _____may be forced by excess pressure over or into a higher point.
A. Undesirable effect
B. Specific location
C. Stop or prevent
D. Destructive manner
E. None of Above

169. **Corrosion:** The removal of metal from copper, other metal surfaces and concrete surfaces in a _____. Corrosion is caused by improperly balanced water or excessive water velocity through piping or heat exchangers.
A. Undesirable effect
B. Specific location
C. Stop or prevent
D. Destructive manner
E. None of Above

170. **Cross-Contamination:** The _____ of two unlike qualities of water. For example the mixing of good water with a polluting substance like a chemical substance.
A. Undesirable effect
B. Specific location
C. Stop or prevent
D. Destructive manner
E. None of Above

171. **Density:** Is a _____of matter, as each element and compound has a unique density associated with it.
A. Inhibit growth
B. Physical property
C. With agitation
D. Treatment
E. Object moving

172. Density defined in a _____as the measure of the relative "heaviness" of objects with a constant volume.
A. Inhibit growth
B. Physical property
C. Qualitative manner
D. Treatment

173. **Dilatant Fluids:** Shear Thickening Fluids or Dilatant Fluids increase their viscosity with agitation. Some of these liquids can become almost solid within a pump or pipe line. _____, cream becomes butter and Candy compounds, clay slurries and similar heavily filled liquids do the same thing.
A. Inhibit growth
B. Physical property
C. With agitation
D. Treatment
E. Object moving

174. **Disinfect:** To kill and _____of harmful bacterial and viruses in drinking water.
A. Inhibit growth
B. Physical property
C. With agitation
D. Treatment
E. Object moving

175. **Disinfection:** The _____of water to inactivate, destroy, and/or remove pathogenic bacteria, viruses, protozoa, and other parasites.
A. Inhibit growth
B. Physical property
C. With agitation
D. Treatment
E. Object moving

176. **Drag Coefficient:** The drag coefficient is used to express the drag of an object in moving fluid. Any _____through a fluid will experience a drag - the net force in direction of flow due to the pressure and shear stress forces on the surface of the object.
A. Inhibit growth
B. Physical property
C. With agitation
D. Treatment
E. Object moving

177. **Dynamic, Absolute and Kinematic Viscosity:** The viscosity of a fluid is an important property in the analysis of liquid behavior and fluid motion near solid boundaries. The viscosity is the fluid resistance to shear or flow and is a measure of the _____or frictional fluid property. The resistance is caused by intermolecular friction exerted when layers of fluids attempts to slide by another .
A. Fluids kinetic energy
B. Adhesive/cohesive
C. Horizontal plane
D. Resistance to shear
E. None of the Above

178. **Dynamic (absolute) Viscosity:** is the tangential force per unit area required to move one _____with respect to the other at unit velocity when maintained a unit distance apart by the fluid.
A. Fluids kinetic energy
B. Adhesive/cohesive
C. Horizontal plane
D. Resistance to shear
E. None of the Above

179. **Dynamic or Absolute Viscosity:** The viscosity of a fluid is an important property in the analysis of liquid behavior and fluid motion near solid boundaries. The viscosity of a fluid is its resistance to shear or flow and is a measure of the _____or frictional properties of a fluid. The resistance is caused by intermolecular friction exerted when layers of fluids attempts to slide by another .
A. Fluids kinetic energy
B. Adhesive/cohesive
C. Horizontal plane
D. Resistance to shear
E. None of the Above

180. **Dynamic Pressure:** Dynamic pressure is the component of fluid pressure that represents a _____.
A. Fluids kinetic energy
B. Adhesive/cohesive
C. Horizontal plane
D. Resistance to shear
E. None of the Above

181. **Elevation Head:** The _____per unit weight of a fluid because of its elevation. 1 foot of water will produce .433 pounds of pressure head.
A. Ability to do work
B. Hydraulic grade
C. Velocity profile
D. Energy possessed
E. None of the Above

182. **Energy:** The _____. Energy can exist in one of several forms, such as heat, light, mechanical, electrical, or chemical. Energy can be transferred to different forms. It also can exist in one of two states, either potential or kinetic.
A. Ability to do work
B. Hydraulic grade
C. Velocity profile

183. **Energy and Hydraulic Grade Line:** The _____and the energy line are graphical forms of the Bernoulli equation. For steady, in viscid, incompressible flow the total energy remains constant along a stream line as expressed through the Bernoulli
A. Ability to do work
B. Hydraulic grade
C. Velocity profile
D. Energy possessed
E. None of the Above

184. **Entrance Length and Developed Flow:** Fluid needs some length to _____ profile after entering the pipe or after passing through components such as bends, valves, pumps, turbines or similar.
A. Ability to do work
B. Hydraulic grade
C. Velocity profile
D. Energy possessed
E. None of the Above

185. A fluid is defined as a substance that continually deforms (flows) under an applied shear _____ regardless of the magnitude of the applied stress.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

186. It is a subset of the phases of matter and includes _____, gases, plasmas and, to some extent, plastic solids.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

187. Fluids are also divided into liquids and gases. Liquids form a free surface (that is, a surface not created by their container) while _____ do not.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

188. The distinction between solids and fluids is not so obvious. The distinction is made by evaluating the _____ of the matter: for example silly putty can be considered either a solid or a fluid, depending on the time period over which it is observed.
A. Stress
B. Pressure
C. Static equilibrium
D. None of the Above

189. _____ share the properties of not resisting deformation and the ability to flow (also described as their ability to take on the shape of their containers).
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

190. These properties are typically a function of their inability to support a shear _____ in static equilibrium.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

191. While in a solid, _____ is a function of strain, in a fluid, stress is a function of rate of strain.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

192. A consequence of this behavior is Pascal's law which entails the important role of pressure in characterizing a fluid's state. Based on how the _____ depends on the rate of strain and its derivatives, fluids can be characterized as: Newtonian fluids are where stress is directly proportional to rate of strain.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

193. Non-Newtonian fluids are where _____ is proportional to rate of strain, its higher powers and derivatives (basically everything other than Newtonian fluid).
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures

194. The behavior of fluids can be described by a set of partial differential equations, which are based on the _____ of mass, linear and angular momentum (Navier-Stokes equations) and energy. The study of fluids is fluid mechanics, which is subdivided into fluid dynamics and fluid statics depending on whether the fluid is in motion or not.
A. Stress
B. Pressure
C. Static equilibrium
D. None of the Above

195. A gas is one of the four major phases of matter (after solid and liquid, and followed by plasma) that subsequently appear as a solid material is subjected to increasingly higher _____.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

196. As energy in the form of heat is added, a solid (e.g., ice) will first melt to become a liquid (e.g., water), which will then boil or evaporate to become a gas (e.g., water vapor). In some circumstances, a solid (e.g., "dry ice") can directly turn into a gas: this is called _____.
A. Stress
B. Pressure
C. Static equilibrium
D. Temperatures
E. None of the Above

197. **Gauge Pressure:** Pressure differential above or below ambient _____ pressure.
A. Atmosphere
B. Atmospheric
C. Head
D. Pressure

198. **Hazardous Atmosphere:** An _____ which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.
A. Atmosphere
B. Atmospheric
C. Head
D. Pressure

199. **Hazen-Williams Factor:** Hazen-Williams factor for some common piping materials. Hazen-Williams coefficients are used in the _____ for friction loss calculation in ducts and pipes.
A. Atmosphere
B. Atmospheric
C. Head
D. Pressure
E. None of the Above

200. The height of a column or body of fluid above a given point expressed in linear units. _____ is often used to indicate gauge pressure.
A. Atmosphere
B. Atmospheric
C. Head
D. Pressure

201. _____ is equal to the height times the density of the liquid. The measure of the pressure of water expressed in feet of height of water. 1 psi = 2.31 feet of water. There are various types of heads of water depending upon what is being measured. Static (water at rest) and Residual (water at flow conditions).
A. Atmosphere
B. Atmospheric
C. Head
D. Pressure
E. None of the Above

202. _____ is a branch of science and engineering concerned with the use of liquids to perform mechanical tasks.
A. Knudsen Number
B. Hydraulics
C. Laminar Flow
D. Kinematic Viscosity
E. Hydrodynamics

203. _____ is the fluid dynamics applied to liquids, such as water, alcohol, and oil.
A. Knudsen Number
B. Hydraulics
C. Laminar Flow
D. Kinematic Viscosity
E. Hydrodynamics

204. _____**:** Is the ratio of absolute or dynamic viscosity to density.
A. Knudsen Number
B. Hydraulics
C. Laminar Flow
D. Kinematic Viscosity
E. Hydrodynamics

205. _____ The ability of an object to do work by virtue of its motion. The energy terms that are used to describe the operation of a pump are pressure and head.
A. Knudsen Number
B. Hydraulics
C. Laminar Flow
D. Kinematic Viscosity
E. None of the Above

206. _____ Used by modelers who wish to express a non- dimensionless speed.
A. Knudsen Number
B. Hydraulics
C. Laminar Flow
D. Kinematic Viscosity
E. Hydrodynamics

207. _____ **:** The resistance to flow in a liquid can be characterized in terms of the viscosity of the fluid if the flow is smooth. In the case of a moving plate in a liquid, it is found that there is a layer or lamina which moves with the plate, and a layer which is essentially stationary if it is next to a stationary plate.
A. Knudsen Number
B. Hydraulics
C. Laminar Flow
D. Kinematic Viscosity
E. Hydrodynamics

208. _____ The maximum allowable level of a contaminant that federal or state regulations allow in a public water system. If the MCL is exceeded, the water system must treat the water so that it meets the MCL. Or provide adequate backflow protection.
A. Microbe, Microbial
B. Microbial Contaminants
C. Maximum Contamination Levels
D. Pathogens
E. None of the Above

209. _____The process of breaking down organic wastes into simpler elemental forms or by products. Also used to separate combined chlorine and convert it into free chlorine.
A. Microbe, Microbial
B. Microbial Contaminants
C. Maximum Contamination Levels
D. Pathogens
E. None of the Above

210. _____ A measure of the acidity of water.
A. Microbe, Microbial
B. Microbial Contaminants
C. Maximum Contamination Levels
D. Pathogens
E. None of the Above

211. _____Any minute, simple, single-celled form of life, especially one that causes disease.
A. Microbe, Microbial
B. Microbial Contaminants
C. Maximum Contamination Levels
D. Pathogens
E. None of the Above

212. _____Disease-causing pathogens; waterborne pathogens. A pathogen is a bacterium, virus or parasite that causes or is capable of causing disease. Pathogens may contaminate water and cause waterborne disease.
A. Microbe, Microbial
B. Microbial Contaminants
C. Pathogens

213. _____ Microscopic organisms present in untreated water that can cause waterborne diseases.
A. Microbe, Microbial
B. Microbial Contaminants
C. Maximum Contamination Levels
D. Pathogens
E. None of the Above

214. **Pascal's Law:** A pressure applied to a confined fluid at rest is transmitted with _____ throughout the fluid.
A. Gradually fills
B. Incompressible and viscosity
C. Equal intensity
D. Turbulent flow
E. Shear stress

215. **Navier-Stokes Equations:** The motion of a non-turbulent, Newtonian fluid is governed by the Navier-Stokes equation. The equation can be used to model _____, where the fluid parameters are interpreted as time-averaged values.
A. Gradually fills
B. Incompressible and viscosity
C. Equal intensity
D. Turbulent flow
E. Shear stress

216. **Newtonian Fluid:** Newtonian fluid (named for Isaac Newton) is a fluid that flows like water—its _____is linearly proportional to the velocity gradient in the direction perpendicular to the plane of shear.
A. Gradually fills
B. Incompressible and viscosity
C. Equal intensity
D. Turbulent flow
E. Shear stress

217. The constant of proportionality is known as the viscosity. _____, because it continues to exemplify fluid properties no matter how fast it is stirred or mixed.
A. Water is Newtonian
B. Incompressible and viscosity
C. Equal intensity
D. Turbulent flow
E. Shear stress

218. Contrast this with a non-Newtonian fluid, in which stirring can leave a "hole" behind (that _____up over time - this behavior is seen in materials such as pudding, or to a less rigorous extent, sand), or cause the fluid to become thinner, the drop in viscosity causing it to flow more (this is seen in non-drip paints).
A. Gradually fills
B. Incompressible and viscosity
C. Equal intensity

219. For a Newtonian fluid, the viscosity, by definition, depends only on temperature and pressure (and also the chemical composition of the fluid if the fluid is not a pure substance), not on the forces acting upon it. If the fluid is _____is constant across the fluid, the equation governing the shear stress.
A. Gradually fills
B. Incompressible and viscosity
C. Equal intensity
D. Turbulent flow
E. Shear stress

220. _____describes the forces acting on objects interacting with each other.
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law
E. Lift

221._____can be expressed as"If one object exerts a force **F** on another object, then the second object exerts an equal but opposite force **F** on the first object"
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law
E. Lift

222. Force is a convenient abstraction to represent mentally the pushing and pulling interaction between objects.
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law

223. It is common to express forces as vectors with magnitude, direction and point of application. The net effect of two or more forces acting on the same point is the vector sum of the forces.
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law

224. _____viscosity changes with the applied shear force.
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law

225. _____For a perfect or ideal gas the change in density is directly related to the change in temperature and pressure as expressed in the Ideal Gas Law.
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law
E. Lift

226. _____ Describes the behavior of gravitational, electric, and fluid potentials.
A. Isentropic
B. Laplace's Equation
C. Non-Newtonian fluid
D. Newton's Third Law
E. Lift

227. _____consists of the sum of all the aerodynamic forces normal to the direction of the external airflow.
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law
E. Lift

228. Liquids are an in-between state of _____.
A. Compress
B. Matter
C. Gas
D. Liquids
E. Solids

229. Liquids can be found in between the solid and _____ states.
A. Compress
B. Matter
C. Gas
D. Liquids
E. Solids

230. _____ don't have to be made up of the same compounds. If you have a variety of materials in a liquid, it is called a solution.
A. Matter
B. Gas
C. Liquids

231. Another trait of _____ is that they are difficult to compress.
A. Compress
B. Matter
C. Gas
D. Liquids
E. Solids

232. When you compress something, you take a certain amount and force it into a smaller space. _____ are very difficult to compress and gases are very easy.
A. Compress
B. Matter
C. Gas
D. Liquids
E. Solids

233. Liquids are in the middle but tend to be difficult. When you compress something, you force the atoms closer together. When _____ go up, substances are compressed.
A. Bounce
B. Molecules
C. Evaporation
D. Shock absorbers
E. None of the Above

234. Liquids already have their atoms close together, so they are hard to compress. Many _____in cars compress liquids in tubes.
A. Bounce
B. Molecules
C. Evaporation
D. Shock absorbers
E. None of the Above

235. A special force keeps _____. Solids are stuck together and you have to force them apart.
A. Bounce
B. Molecules
C. Evaporation
D. Shock absorbers
E. None of the Above

236. Gases _____ everywhere and they try to spread themselves out.
A. Bounce
B. Molecules
C. Evaporation
D. Shock absorbers
E. None of the Above

237. Liquids actually want to stick together. There will always be the occasional evaporation where extra energy gets a _____ excited and the molecule leaves the system.
A. Bounce
B. Molecule
C. Evaporation
D. Shock absorbers
E. None of the Above

238. Overall, liquids have cohesive (sticky) forces at work that hold the _____ together.
A. Bounce
B. Molecules
C. Evaporation
D. Shock absorbers

239. **Isentropic Compression/Expansion Process:** If the compression or expansion takes place under constant volume conditions - the process is called _____**.**
A. Isentropic
B. Ideal Gas Law
C. Non-Newtonian fluid
D. Newton's Third Law
E. Lift

240. **Manning Formula for Gravity Flow:** Manning's equation can be used to calculate cross-sectional _____in open channels.
A. Average velocity flow
B. State enabling
C. Virtue of its position
D. Control leakage
E. Speed of sound

241. **Mechanical Seal:** A mechanical device used to _____from the stuffing box of a pump. Usually made of two flat surfaces, one of which rotates on the shaft. The two flat surfaces are of such tolerances as to prevent the passage of water between them.
A. Average velocity flow
B. State enabling
C. Virtue of its position
D. Control leakage
E. Speed of sound

242. **Mach Number:** When an object travels through a medium, then its Mach number is the ratio of the object's speed to the _____ in that medium.
A. Average velocity flow
B. State enabling
C. Virtue of its position
D. Control leakage
E. Speed of sound

243. **Potential Energy:** The energy that a body has by virtue of its position or _____it to do work.
A. Average velocity flow
B. State enabling
C. Virtue of its position
D. Control leakage

244. **Prandtl Number:** The Prandtl Number is a dimensionless number approximating the ratio of momentum diffusivity and _____.
A. Average velocity flow
B. State enabling
C. Virtue of its position
D. Control leakage
E. Thermal diffusivity

245. **Static Head:** The height of a column or body of_____above a given point
A. Temperature
B. Liquid
C. Pressure
D. Fluid
E. Specific weight

246. **Static Pressure:** The _____ in a fluid at rest.
A. Temperature
B. Liquid
C. Pressure
D. Fluid
E. Specific weight

247. **Static Pressure and Pressure Head in Fluids:** The pressure indicates the normal force per unit area at a given point acting on a given plane. Since there is no shearing stresses present in a fluid at rest - the _____ in a fluid is independent of direction.
A. Temperature
B. Liquid
C. Pressure
D. Fluid
E. Specific weight

248. For fluids - liquids or gases - at rest the pressure gradient in the vertical direction depends only on the _____of the fluid.
A. Temperature
B. Liquid
C. Pressure
D. Fluid
E. Specific weight

249. The atmospheric pressure is the pressure in the surrounding air. It varies with _____ and altitude above sea level.
A. Temperature
B. Liquid
C. Pressure
D. Fluid

250. **Pressure Head:** The height to which _____ can be raised by a given pressure.
A. Temperature
B. Liquid
C. Pressure
D. Fluid
E. Specific weight

251. **Pressure Units:** Since 1 Pa is a small _____ unit, the unit hectopascal (hPa) is widely used, especially in meteorology. The unit kilopascal (kPa) is commonly used designing technical applications like HVAC systems, piping systems and similar.
A. Temperature
B. Liquid
C. Pressure
D. Fluid

252. **Reynolds Number:** The Reynolds number is used to determine whether a flow is laminar or turbulent. The Reynolds Number is a _____defined by the ratio of dynamic pressure (ρu^2) and shearing stress ($\mu u / L$.
A. Kinetic energy
B. Weight
C. Temperature
D. Nondimensional parameter

253. **Richardson Number:** A dimensionless number that expresses the ratio of potential to _____.
A. Kinetic energy
B. Weight
C. Temperature
D. Nondimensional parameter

254. **Specific Gravity:** The Specific Gravity - SG - is a dimensionless unit defined as the ratio of density of the material to the density of water at a specified _____.
A. Kinetic energy
B. Weight
C. Temperature
D. Nondimensional parameter
E. Fluid flow dynamics

255. **Specific Weight:** Specific Weight **is** defined as weight per unit volume. _____ is a **force**.
A. Kinetic energy
B. Weight
C. Temperature
D. Nondimensional parameter
E. Fluid flow dynamics

256. **Strouhal Number:** The Strouhal number is a quantity describing oscillating flow mechanisms. The Strouhal Number is a dimensionless value useful for analyzing oscillating, unsteady _____problems.
A. Kinetic energy
B. Weight
C. Temperature
D. Nondimensional parameter
E. Fluid flow dynamics

257. **Stuffing Box:** That portion of the pump which houses the packing or _____.
A. Mechanical seal
B. Volute
C. Ball
D. Supersonic
E. None of the Above

258. **Valve:** A device that opens and closes to regulate the flow of liquids. Faucets, hose bibs, and _____ are examples of valves.
A. Mechanical seal
B. Volute
C. Ball
D. Supersonic
E. None of the Above

259. **Vane:** That portion of an impeller which throws the water toward the _____.
A. Mechanical seal
B. Volute
C. Ball
D. Supersonic
E. None of the Above

260. **Supersonic Flow:** Flow with speed above the speed of sound, 1,225 km/h at sea level, is said to be _____.
A. Mechanical seal
B. Volute
C. Ball
D. Supersonic

261. Surface tension is a force within the surface layer of a liquid that causes the layer to behave as an _____.
A. Surface tension
B. Elastic sheet
C. Surface
D. All of the Above
E. None of the Above

262. The cohesive forces between liquid molecules are responsible for the phenomenon known as _____.
A. Surface tension
B. Elastic sheet
C. Surface
D. All of the Above
E. None of the Above

263. The molecules at the surface do not have other like molecules on all sides of them and consequently they cohere more strongly to those directly associated with them on the _____.
A. Surface tension
B. Elastic sheet
C. Surface

264. This forms a surface "film" which makes it more difficult to move an object through the _____ than to move it when it is completely submersed.
A. Surface tension
B. Elastic sheet
C. Surface

265. Surface tension is typically measured in dynes/cm, the force in dynes required to break a film of length 1 cm. Equivalently, it can be stated as surface energy in _____ per square centimeter.
A. Surface tension
B. Elastic sheet
C. Surface
D. All of the Above
E. None of the Above

266. Water at 20°C has a _____of 72.8 dynes/cm compared to 22.3 for ethyl alcohol and 465 for mercury.
A. Surface tension
B. Elastic sheet
C. Surface
D. All of the Above

267. **Thixotropic Fluids: Shear Thinning Fluids** or **Thixotropic Fluids** reduce their _____ or pressure is increased at a constant temperature. Ketchup and mayonnaise are examples of thixotropic materials. They appear thick or viscous but are possible to pump quite easily.
A. Viscosity as agitation
B. Used to measure
C. Speed at velocities
D. Measure of the cloudiness

268. **Transonic:** Flow with _____just below and above the speed of sound is said to be transonic.
A. Viscosity as agitation
B. Used to measure
C. Speed at velocities
D. Measure of the cloudiness
E. Using liquid columns

269. **Turbidity:** A _____of water caused by suspended particles.
A. Viscosity as agitation
B. Used to measure
C. Speed at velocities
D. Measure of the cloudiness
E. Using liquid columns

270. **U-Tube Manometer:** Pressure measuring devices _____in vertical or inclined tubes are called manometers.
A. Viscosity as agitation
B. Used to measure
C. Speed at velocities
D. Measure of the cloudiness
E. Using liquid columns

271. One of the most common is the water filled u-tube manometer _____pressure difference in pitot or orifices located in the airflow in air handling or ventilation system.
A. Viscosity as agitation
B. Used to measure
C. Speed at velocities
D. Measure of the cloudiness
E. Using liquid columns

272. Vorticity is defined as the _____ per unit area at a point in the flow field.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure
E. None of the Above

273. _____For a particular substance at any given temperature there is a pressure at which the vapor of that substance is in equilibrium with its liquid or solid forms.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure
E. None of the Above

274. _____ The vertical distance a liquid must fall to acquire the velocity with which it flows through the piping system.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure

275. _____For a given quantity of flow, the velocity head will vary indirectly as the pipe diameter varies.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure
E. None of the Above

276. Informally, _____ is the quantity that describes a fluid's resistance to flow.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure
E. None of the Above

277. Fluids resist the relative motion of immersed objects through them as well as to the motion of layers with differing velocities within them.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure
E. None of the Above

278. Wave drag refers to a sudden and very powerful drag that appears on aircrafts flying at _____.
A. Viscosity
B. Velocity Head
C. Vorticity
D. Vapor Pressure
E. None of the Above

279. Hydraulics is applied commonly to the study of the mechanical properties of water, other liquids, and even gases when the effects of _____ are small.
A. Hydrokinetics
B. Hydrostatics
C. Hydraulics
D. Compressibility

280. Telemetering systems must often transmit more than one signal. Which of the following is **not** a means for transmitting multiple signals?
A. Pulse-duration modulation
B. Polling
C. Scanning
D. Multiplexing

281. The Strain Gauge is a common measuring device used for a variety of changes such as head. As the pressure in the system changes, the diaphragm expands which changes the length of the wire attached. This change of length of the wire changes the _____of the wire, which is then converted to head.
A. Resistance
B. Voltage
C. Current

282. As the wear ring inside a centrifugal pump looses tolerance between the impeller and wear ring, the efficiency of the pump will ?
A. Remain the same
B. Fluctuates with the velocity of water
C. Increase
D. Decrease
E. None of the above

283. Multistage centrifugal pumps can discharge high pressure water. The pressure increases with the number of stages but what happens to the capacity/ flow of the pump?
A. The flow is decreased by 25% for each stage
B. The flow will remain the same through each stage
C. The flow will double with each stage

284. What is the function of speed controls on valve actuators?
A. A SCADA function
B. To prevent a water hammer
C. To prevent backflow
D. All of the above

285. With remote manual control, the operator is also required to turn a switch or push a button to operate equipment. Control devices which actuate equipment by inducing a _____in the device are commonly known as _____.
A. Electric charge, SCADA
B. Magnetic field, Solenoids
C. Electric charge, Full Duplexing switches
D. EMF, Helical Sensors

286. This type of valve which controls water pressure operates by restricting flows. They are used to deliver water from a high pressure to a low pressure system. The pressure downstream from the valve regulates the amount of flow. Usually, these valves are of the globe design and have a spring-loaded diaphragm that sets the size of the opening.
A. Pressure Regulation Valve
B. A Butterfly Valve
C. Reduced Pressure
D. Check Valve

287. What is the intent of a designer when multiple water pumps are installed for paralleled operation?
A. To increase the discharge head
B. To provide for a fluctuating demand/or for if one pump is out of service
C. To increase the water force

288. Any equipment that utilizes water for cooling, lubrication, washing or as a solvent is always susceptible to ?
A. Cross connections
B. An operator falling in to it
C. Garden hoses and backpressure
D. All of the above

289. Which of the following has the greatest potential hazard of contamination if a cross connection occurs?
A. Sugar machine
B. Commercial food processors
C. Swimming pools
D. Pesticide mixing tanks

290. What is the most likely consequence if a backsiphonage condition causes a cross connection and pressure is then restored to the system?
A. Probably dirty water
B. There will be no contamination
C. Backpressure
D. The distribution system down stream of the cross connection will be contaminated

291. Why would an operator place a screen before a backflow prevention assembly?
A. Prevent debris from fouling the assembly
B. Prevent small animals from entering the assembly
C. To allow the passage of air
D. To keep insects out of the air relief

292. A single-phase motor is receiving adequate power and the run windings are operable, but the motor will not start, what could be the problem?
A. The switch is closed
B. There is a problem with the stator
C. There is a problem with the start winding
D. There is a problem with the Rotor Monitor

293. Mechanical seals consist of two machined and polished surfaces which must contact each other. This contact is maintained by ?
A. Spring pressure
B. Water pressure

294. Which of the following types of motors would be expected to have the lowest demand for starting current?
A. Wound-rotor induction motor
B. Squirrel Cage induction motor
C. Rotor Synch motor
D. None of the Above

295. The purpose of a sump on a vertical turbine pump is used to maintain adequate?
A. Liquid above the suction level
B. Pressure for the foot valve
C. Backpressure
D. Cavitation diffusion

296. This term is used to describe head pressure or energy lost by water flowing in a pipe or channel as a result of turbulence caused by the velocity of the flowing water and the roughness of the pipe, channel walls, and restrictions by fittings.
A. C Factor
B. Friction Losses
C. Pressure
D. Pressure Head

297. Continuous leakage from a mechanical seal indicates ?
A. An abnormal condition
B. A normal condition
C. Packing needs to be tightened
D. Mechanical gland needs to be replaced
E. All of the above

298. When you are shutting a large valve, which of the following valves will reduce high pressure that can be present?
A. Gate valve
B. Bypass valve
C. Binder device
D. Inserting Valve

299. What is the most likely choice for the result of grease coming in to contact with the windings for a motor?
A. The winding insulation may deteriorate
B. The overloads will trip
C. There will be a phase monitor problem
D. The torque converter will fail

Last question is on the next page

300. An electric motor that has a frequency of 60Hz will have a maximum synchronous speed of ?
A. 600 rpms
B. 3600 rpms
C. 3000 rpms
D. None of the Above

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Thank you…

Special Notice to Help the Less Fortunate

Kavi and the believers in his church prayed fervently and lifted up praise to God before digging the well. We here in the U.S. have it very good. Here is a story of and drilling a well just to have drinking water in India.

Kavi Viresh was accustomed to rejection. A Gospel for Asia missionary, Kavi knew he was laboring in hard soil in his village in Andhra Pradesh, India and the spiritual drought experienced by its people was worse than the physical drought they suffered in the summers. The people of this village lived hard lives focused on daily survival, and most did not have faith in any god.

By God's grace, Kavi has seen a church planted there—and believers who are eager to help him with outreach. Still, the hearts of many in the village have remained hard. Kavi has suffered beatings several times for sharing the Good News of Jesus. One time, a group of 30 people came to his house to attack him. The Gospel tracts he handed out were torn into pieces on many occasions.

"People told me, 'Your God is a great God.'"

But Kavi knew the people weren't really rejecting *him*—they were rejecting *Jesus* who sent him. And he knew there just had to be some way to get through to these people whom Jesus loved so much. That way turned out to be a Jesus Well. Before the Jesus Well was dug in this village, the people's only source of water was one government-built water tank that was not nearly enough to meet their basic needs. Kavi knew the Jesus Well would be a tangible way to show the villagers that Jesus loved them.

Sudhir Rao, a new Christian in the village, gladly provided his services as a mason to help with construction. The digging of the Jesus Well was in itself a miracle. Others had attempted to dig a well in the village but not seen water even at depths of 300 feet. So when Kavi saw water at around 100 feet, villagers were amazed.

"People told me, 'Your God is a great God,'" Kavi recalls. Even the village leader expressed heartfelt appreciation to Kavi for providing his people with water—and that he desired to see another well dug in a nearby area. Although the well was just dug in recent months, Kavi has already seen God wash away barriers in the villagers' hearts through its refreshing waters. Hearts have been brought that much closer to being able to receive the message of hope in Christ. And he has a vision of faith for how God will continue to work. "Through this Jesus Well, surely those who have beaten me and are against me will come to know the Lord Jesus," Kavi shared.

For more information, we welcome you to visit…

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