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- 1. A B C D
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| 79. A B C D | 110. A B C D | 141. A B C D | 172. A B C D |
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| 83. A B C D | 114. A B C D | 145. A B C D | 176. A B C D |
| 84. A B C D | 115. A B C D | 146. A B C D | 177. A B C D |
| 85. A B C D | 116. A B C D | 147. A B | 178. A B C D |
| 86. A B C D | 117. A B C D | 148. A B | 179. A B C D |
| 87. A B C D | 118. A B C D | 149. A B | 180. A B C D |
| 88. A B C D | 119. A B C D | 150. A B | 181. A B C D |
| 89. A B C D | 120. A B C D | 151. A B | 182. A B C D |
| 90. A B | 121. A B C D | 152. A B | 183. A B C D |
| 91. A B | 122. A B C D | 153. A B | 184. A B C D |
| 92. A B | 123. A B C D | 154. A B | 185. A B |
| 93. A B | 124. A B C D | 155. A B | 186. A B |
| 94. A B C D | 125. A B C D | 156. A B C D | 187. A B |
| 95. A B C D | 126. A B C D | 157. A B C D | 188. A B |
| 96. A B C D | 127. A B C D | 158. A B C D | 189. A B |
| 97. A B C D | 128. A B C D | 159. A B C D | 190. A B |
| 98. A B C D | 129. A B C D | 160. A B C D | 191. A B C D |
| 99. A B C D | 130. A B C D | 161. A B C D | 192. A B |
| 100. A B C D | 131. A B C D | 162. A B C D | 193. A B C D |
| 101. A B C D | 132. A B C D | 163. A B C D | 194. A B C D |
| 102. A B C D | 133. A B C D | 164. A B C D | 195. A B |
| 103. A B C D | 134. A B C D | 165. A B C D | 196. A B |
| 104. A B C D | 135. A B C D | 166. A B C D | 197. A B |
| 105. A B C D | 136. A B C D | 167. A B C D | 198. A B C D |
| 106. A B C D | 137. A B C D | 168. A B C D | 199. A B C D |
| 107. A B C D | 138. A B C D | 169. A B C D | 200. A B C D |

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If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00.

Pump Primer 2 CEU Training Course Assignment

The Pump Primer 2 CEU course assignment is available in Word on the Internet for your convenience, please visit www.ABCTLIC.com and download the assignment and e-mail it back to TLC.

You will have 90 days from receipt of this manual to complete it in order to receive your Professional Development Hours (PDHs) or Continuing Education Unit (CEU). A score of 70 % or better is necessary to pass this course. If you should need any assistance, please email or fax all concerns and the completed ANSWER KEY to info@tlch2o.com.

Select one answer per question. Please utilize the answer key. If you see (s) in the answer, this means the answer could be singular or plural.

If you find any error or problem with the question or the answer, please write that concern down and notify us of this issue.

Please write down any questions you were not able to find the answers or that have errors.

Review

Fluid Mechanics and Hydraulic Principles Section

- Which of the following definitions is the force per unit area, usually expressed in pounds per square inch?
A. Pressure
B. Hydraulics
C. Pascal's Law
D. None of the above
- Which of the following definitions is the pressure differential above or below ambient atmospheric pressure?
A. Pressure, Atmospheric
B. Pressure, Static
C. Pressure, Gauge
D. None of the above
- Which of the following definitions is height of a column or body of fluid above a given point expressed in linear units?
A. Head, Friction
B. Head
C. Hydraulics
D. None of the above
- Which of the following definitions is required to overcome the friction at the interior surface of a conductor and between fluid particles in motion?
A. Head, Friction
B. Head, static
C. Hydraulics
D. None of the above
- Which of the following definitions is often used to indicate gauge pressure?
A. Head, Friction
B. Head
C. Hydraulics
D. None of the above
- Which of the following definitions is the pressure applied to a confined fluid at rest is transmitted with equal intensity throughout the fluid?
A. Pressure
B. Hydraulics
C. Pascal's Law
D. None of the above

7. Which of the following definitions is the application of continuous force by one body upon another that it is touching; compression?
 A. Pressure C. Pascal's Law
 B. Hydraulics D. None of the above
8. Which of the following definitions varies with flow, size, type, and conditions of conductors and fittings, and the fluid characteristics?
 A. Head, Friction C. Hydraulics
 B. Head, static D. None of the above
9. Which of the following definitions is the pressure in a fluid at rest?
 A. Pressure, Atmospheric C. Pressure, Gauge
 B. Pressure, Static D. None of the above
10. Which of the following definitions is the height of a column or body of fluid above a given point?
 A. Head, Friction C. Hydraulics
 B. Head, static D. None of the above
11. Which of the following definitions is the pressure exported by the atmosphere at any specific location?
 A. Pressure, Atmospheric C. Pressure, Gauge
 B. Pressure, Static D. None of the above
12. Which of the following definitions is pressure above zone absolute, i.e. the sum of atmospheric and gauge pressure?
 A. Pressure, Absolute C. Pressure, Gauge
 B. Pressure D. None of the above
13. Which of the following definitions is the pressure is equal to the height times the density of the liquid?
 A. Head, static C. Hydrokinetics
 B. Head D. None of the above
14. Sea level pressure is approximately 2.31 pounds per square inch absolute, 1 bar = .433psi.
 A. True B. False

Hydraulics

15. Which of the following includes the behavior of all liquids, although it is primarily concerned with the motion of liquids?
 A. Fluids C. Hydraulics
 B. Hydrostatics D. None of the above
16. 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
17. Hydraulics is a branch of engineering concerned mainly with moving liquids.
 A. True B. False

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

- A. Hydrokinetics
- B. Hydrostatics
- C. Hydraulics
- D. None of the above

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

- A. Fluids
- B. Hydrokinetics
- C. Mechanical properties of water
- D. None of the above

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

- A. Hydrokinetics
- B. Hydrostatics
- C. Hydraulics
- D. None of the above

21. Which of the following 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. Hydrokinetics
- B. Hydrostatics
- C. Hydraulics
- D. None of the above

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

- A. Pressure
- B. Hydrokinetics
- C. Hydraulics
- D. None of the above

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

- A. Pressure
- B. Hydrostatics
- C. Hydraulics
- D. None of the above

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

- A. Pressure
- B. Hydrokinetics
- C. Hydrostatics
- D. None of the above

What is Fluid Mechanics?

25. Fluid mechanics is a science concerned with the response of fluids to_____.

- A. Forces
- B. Its velocity
- C. Forces exerted upon them
- D. None of the above

Pumps and Pumping Water Section

Common Types of Water Pumps

26. The most common type of water pumps used for municipal and domestic water supplies are variable displacement pumps another term for_____.

- A. Dynamic pump(s)
- B. Turbine pump(s)
- C. Variable displacement pump(s)
- D. None of the above

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

- A. Dynamic pump(s)
- B. Turbine pump(s)
- C. Variable displacement pump(s)
- D. None of the above

28. Which of the following are variable displacement pumps that are by far used the most? The water production well industry almost exclusively uses Turbine pumps, which are a type of centrifugal pump.
- A. Dynamic pump(s) C. Variable displacement pump(s)
 B. Centrifugal pumps D. None of the above
29. Which of the following utilizes impellers enclosed in single or multiple bowls or stages to lift water by centrifugal force? The impellers may be of either a semi-open or closed type.
- A. Dynamic pump(s) C. Variable displacement pump(s)
 B. Turbine pump(s) D. None of the above
30. Impellers are rotated by the _____, which provides the horsepower needed to overcome the pumping head.
- A. Pump motor C. Shaft rotated by a motor
 B. Pumping rate D. None of the above
31. The size and number of stages, horsepower of the motor and _____ are the key components relating to the pump's lifting capacity.
- A. Impeller(s) C. Pumping head
 B. Pumping rate D. None of the above
32. Which of the following pumps are commonly used in groundwater wells but also in many other applications?
- A. Dynamic C. Variable displacement
 B. Vertical turbine D. None of the above
33. Vertical turbine pumps are driven by a shaft rotated by a motor that is usually found on the surface. The shaft turns the _____ within the pump housing while the water moves up the column.
- A. Impeller(s) C. Shaft rotated by a motor
 B. Pumping rate D. None of the above
34. The rotating shaft in a _____ is actually housed within the column pipe that delivers the water to the surface.
- A. Line shaft turbine C. Variable displacement pump(s)
 B. Shaft pump(s) D. None of the above
35. The size of the column, impeller, and bowls are selected based on which desired requirements?
- A. Pumping head C. Pumping rate and lift
 B. Pumping rate D. None of the above
36. Column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by _____.
- A. Oil bearings C. Column bearings
 B. Spider bearings D. None of the above
37. The spider bearings provide both a seal at the _____ and keep the shaft aligned within the column. The water passing through the column pipe serves as the lubricant for the bearings.
- A. Check valve C. Column pipe joints
 B. Strainer D. None of the above

38. Some vertical turbines are lubricated by hydraulic fluid rather than water; these pumps are essentially the same as non-lubricated units; only the drive shaft is enclosed within the transmission.

- A. True B. False

39. Careful operation of oil lubricated turbines is needed to ensure that the pumping levels do not drop enough to allow oil to enter the pump, both water and oil lubricated turbine pump units can be driven by electric or fuel powered motors.

- A. True B. False

40. When the line shaft turbine is turned on a time delay fuse assembly is often installed on these motors to prevent the motor from turning off before reverse rotation stops or simply not allow it to reverse at all.

- A. True B. False

41. Most installations use an electric motor that is connected to the drive shaft by a _____.

- A. Drift pin C. Pair of strong cotter pins
B. Keyway and nut D. None of the above

42. Where electricity is not readily available, fuel powered engines may be connected to the drive shaft by a _____.

- A. Drive shaft C. Right angle drive gear
B. Keyway and nut D. None of the above

43. Both oil and water lubricated systems will have a strainer attached to the intake to prevent _____ from entering the pump.

- A. Hydraulic fluid C. Neither oil nor air
B. Sediment D. None of the above

44. When the line shaft turbine is turned off, _____ will flow back down the column, turning the impellers in a reverse direction. A pump and shaft can easily be broken if the motor were to turn on during this process.

- A. Hydraulic fluid C. Water
B. Sediment D. None of the above

Three Main Types of Diaphragm Pumps

45. In the first type, the diaphragm is sealed with one side in the fluid to be pumped, and the other in _____.

- A. Hydraulic fluid C. Air or hydraulic fluid
B. Sediment D. None of the above

46. The diaphragm is flexed, causing the volume of the pump chamber to increase and decrease. A pair of non-return check valves prevents reverse flow of the _____.

- A. Fluid C. Air
B. Sediment D. None of the above

47. The second type of diaphragm pump works with volumetric positive displacement, but differs in that the prime mover of the diaphragm is _____; but is electro-mechanical, working through a crank or geared motor drive. This method flexes the diaphragm through simple mechanical action, and one side of the diaphragm is open to air.

- A. Hydraulic fluid
- B. Sediment
- C. Neither oil nor air
- D. None of the above

48. When the volume of a chamber of either type of pump is increased (the diaphragm moving up), the pressure decreases, and fluid is drawn into the chamber. When the chamber pressure later increases from decreased volume (the diaphragm moving down), the _____ previously drawn in is forced out.

- A. Fluid
- B. Volume
- C. Vapor pressure
- D. None of the above

49. Finally, the diaphragm moving up once again draws _____ into the chamber, completing the cycle. This action is similar to that of the cylinder in an internal combustion engine.

- A. Fluid
- B. Volume
- C. Vapor pressure
- D. None of the above

Cavitation

50. Cavitation is defined as the phenomenon of formation of _____ of a flowing liquid in a region where the pressure of the liquid falls below its vapor pressure.

- A. Fluid
- B. Vapor bubbles
- C. Vapor pressure
- D. None of the above

51. Non-inertial cavitation is the process in which a bubble in a fluid is forced to oscillate in size or shape due to some form of energy input, such as _____.

- A. An acoustic field
- B. Volume
- C. Vapor pressure
- D. None of the above

52. When the cavitation bubbles collapse, they force _____ into very small volumes, thereby creating spots of high temperature and emitting shock waves, the latter of which are the source of rattling noise.

- A. Liquid energy
- B. Volume
- C. Vapor pressure
- D. None of the above

53. Cavitation is, in many cases, an acceptable occurrence.

- A. True
- B. False

54. In devices such as propellers and pumps, cavitation causes a great deal of noise, damage to components, vibrations, and a loss of efficiency.

- A. True
- B. False

55. Although the collapse of a cavity is a relatively low-energy event, highly localized collapses can erode metals, such as steel, over time. The pitting caused by the collapse of cavities produces great wear on components and can dramatically shorten a propeller's or pump's lifetime.

- A. True
- B. False

56. Cavitation is usually divided into three classes of behavior: collisional, transcendental and non-transcendental.

- A. True
- B. False

57. Non-inertial cavitation is the process where a void or bubble in a liquid rapidly collapses, producing a shock wave.

- A. True
- B. False

Complicated Pump Section - Types of Pumps

58. The family of pumps comprises a large number of types based on application and capabilities. The two major groups of pumps are dynamic and positive displacement.

- A. True
- B. False

Dynamic Pumps (Centrifugal Pump)

Centrifugal pumps are classified into three general categories:

59. Which of the following is a centrifugal pump in which the pressure is developed partly by centrifugal force and partly by the lift of the vanes of the impeller on the liquid?

- A. Mixed flow
- C. Radial flow
- B. Axial flow
- D. None of the above

60. Which of the following is a centrifugal pump in which the pressure is developed by the propelling or lifting action of the vanes of the impeller on the liquid?

- A. Mixed flow
- C. Radial flow
- B. Axial flow
- D. None of the above

61. Which of the following is a centrifugal pump in which the pressure is developed wholly by centrifugal force?

- A. Mixed flow
- C. Radial flow
- B. Axial flow
- D. None of the above

Plunger Pump

62. The plunger pump is a positive displacement pump that uses a plunger or piston to force _____ from the suction side to the discharge side of the pump. It is used for heavy sludge.

- A. Solids
- C. Liquid
- B. Pressure
- D. None of the above

63. The movement of the plunger or piston inside the plunger pump creates _____ inside the pump, so you have to be careful that this kind of pump is never operated against any closed discharge valve.

- A. Work
- C. Drag
- B. Pressure
- D. None of the above

64. All discharge valves must be open before the plunger pump is started, to prevent any fast build-up of _____ that could damage the pump.

- A. Metal
- C. Liquid
- B. Pressure
- D. None of the above

Diaphragm Pumps

65. In this type of pump, a diaphragm provides the mechanical action used to force _____ from the suction to the discharge side of the pump. The advantage the diaphragm has over the plunger is that the diaphragm pump does not come in contact with moving metal. This can be important when pumping abrasive or corrosive materials.

- A. Metal
- B. Pressure
- C. Liquid
- D. None of the above

Complicated Pumps - Introduction

66. More complicated pumps have valves allowing them to work repetitively. These are usually check valves that open to allow passage in one direction, and close automatically to prevent _____ flow.

- A. Decreased
- B. Increased
- C. Reverse
- D. None of the above

67. The force pump has two check valves in the cylinder, one for supply and the other for delivery. The supply valve opens when the cylinder volume _____, the delivery valve when the cylinder volume decreases.

- A. Enters
- B. Increases
- C. Reverses flow
- D. None of the above

68. The lift pump has a supply valve and a valve in the piston that allows the liquid to pass around it when the volume of the cylinder is reduced. The delivery in this case is from the upper part of the cylinder, which the _____ does not enter.

- A. Cylinder
- B. Piston
- C. Discharged fluid
- D. None of the above

69. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston. The diaphragm may be moved mechanically, or by the pressure of the fluid on _____.

- A. One side of the diaphragm
- B. Free surface
- C. Reverse flow
- D. None of the above

70. The force and lift pumps are typically used for _____.

- A. Solids
- B. Pressure
- C. Water
- D. None of the above

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

- A. Cylinder
- B. Tank
- C. Discharged fluid
- D. None of the above

72. The maximum lift, or "suction," is determined by the _____, and either cylinder must be within this height of the free surface.

- A. Atmospheric pressure
- B. Pressure
- C. Discharged fluid
- D. None of the above

73. The force pump can give an arbitrarily large pressure to the _____, as in the case of a diesel engine injector.
- A. Solids
 - B. Pressure
 - C. Discharged fluid
 - D. None of the above

Fluid Properties

74. The properties of the fluids being pumped can significantly affect the choice of pump.
- A. True
 - B. False

Key considerations include:

75. When pumping abrasive liquids such as industrial slurries, selecting a pump that will not clog or fail prematurely depends on particle size, hardness, and the volumetric percentage of solids. The properties of the fluids being pumped can significantly affect the choice of pump.
- A. True
 - B. False

76. It is particularly important to consider pump suction-side line losses when pumping _____.
- A. Fluid specific gravity
 - B. Fluid's vapor pressure
 - C. Viscosity fluids
 - D. None of the above

77. Specific gravity affects the _____ required to lift and move the fluid, and must be considered when determining pump power requirements.
- A. Energy
 - B. Fluid's vapor pressure
 - C. Fluid density
 - D. None of the above

78. Pump materials and expansion, mechanical seal components, and packing materials need to be considered with pumped fluids that are hotter than _____ °F.
- A. 100
 - B. 200
 - C. 212
 - D. None of the above

79. The fluid specific gravity is the ratio of the _____ to that of water under specified conditions.
- A. Fluid specific gravity
 - B. Fluid's vapor pressure
 - C. Fluid density
 - D. None of the above

80. Which of the following normally varies directly with temperature, the pumping system designer must know the viscosity of the fluid at the lowest anticipated pumping temperature?
- A. Fluid specific gravity
 - B. Kinematic viscosity
 - C. High viscosity fluids
 - D. None of the above

81. Which of the following is the force per unit area that a fluid exerts in an effort to change phase from a liquid to a vapor, and depends on the fluid's chemical and physical properties?
- A. Fluid specific gravity
 - B. Fluid's vapor pressure
 - C. Viscosity of a fluid
 - D. None of the above

82. Proper consideration of the _____ will help to minimize the risk of cavitation.
- A. Fluid specific gravity
 - B. Fluid's vapor pressure
 - C. Viscosity of a fluid
 - D. None of the above

83. Which of the following is a measure of its resistance to motion?

- A. Fluid specific gravity
- B. Fluid's vapor pressure
- C. Viscosity of a fluid
- D. None of the above

84. Which of the following result in reduced centrifugal pump performance and increased power requirements?

- A. Fluid specific gravity
- B. Fluid's vapor pressure
- C. High viscosity fluids
- D. None of the above

Positive Displacement Pump Sub-Section

85. A positive displacement pump has an expanding cavity on _____ and a decreasing cavity on the discharge side.

- A. The discharge line
- B. A closed valve
- C. The suction side of the pump
- D. None of the above

86. Liquid is allowed to flow into the pump as the cavity on the suction side expands and the liquid is forced out of the discharge as _____. This principle applies to all types of positive displacement pumps whether the pump is a rotary lobe, gear within a gear, piston, diaphragm, screw, progressing cavity, etc.

- A. The cavity collapses
- B. A closed valve
- C. An expanding cavity
- D. None of the above

87. A positive displacement pump, unlike a centrifugal pump, will produce the same flow at a given RPM no matter what _____.

- A. The discharge line
- B. The discharge pressure is
- C. An expanding cavity
- D. None of the above

88. A positive displacement pump cannot be operated against a closed valve on the discharge side of the pump, i.e. it does not have _____ like a centrifugal pump does.

- A. A shut-off head
- B. A closed valve
- C. An expanding cavity
- D. None of the above

89. If a positive displacement pump is allowed to operate against a closed discharge valve, it will continue to produce flow that will increase the pressure in the discharge line until either _____ or the pump is severely damaged or both.

- A. The discharge line
- B. The line bursts
- C. An expanding cavity
- D. None of the above

Centrifugal Pump Sub-Section

90. By definition, a centrifugal pump is a machine. Specifically, a pump is a machine that imparts energy to a fluid. This energy infusion can cause a liquid to flow, rise to a higher level, or both.

- A. True
- B. False

91. Centrifugal pumps may be classified in several ways. For example, they may be either Multi-Stage or Single Stage.

- A. True
- B. False

92. The centrifugal pump is an extremely simple machine. It is a member of a family known as rotary machines and consists of two basic parts: 1) the stationary element or casing (volute) and 2) the rotary element or impeller.
 A. True B. False
93. The impellers used on centrifugal pumps may be classified as single suction or double suction.
 A. True B. False
94. In the operation of a centrifugal pump, the pump “slings” liquid out of the impeller via _____.
 A. Centrifugal force C. Resistance to flow
 B. The amount of resistance to flow D. None of the above
95. A pump does not create pressure; it only provides flow. Pressure is just an indication of the amount of _____.
 A. Centrifugal force C. Resistance to flow
 B. Pressure D. None of the above
96. A single-stage pump has only one impeller. A multi-stage pump has two or more impellers housed together in _____.
 A. Stage C. The eye
 B. One casing D. None of the above
97. As a standard, each impeller acts separately, discharging to the suction of the next stage impeller. This arrangement is called _____.
 A. Centrifugal force C. Series staging
 B. The amount of resistance to flow D. None of the above
98. Centrifugal pumps are also classified as Horizontal or Vertical, depending upon the position of the _____.
 A. Pump shaft C. Eye
 B. Casing D. None of the above
99. The single-suction impeller allows liquid to enter the eye from one side only. The double-suction impeller allows liquid to enter _____ from two directions.
 A. Pump shaft C. The eye
 B. One casing D. None of the above
100. Impellers are also classified as opened or closed. Closed impellers have side walls that extend from the eye to the outer edge of _____.
 A. Pump shaft C. The vane tips
 B. One casing D. None of the above
101. Open impellers do not have these side walls. Some small pumps with single-suction impellers have only a casing wearing ring and no impeller ring. In this type of pump, the casing wearing ring is fitted into _____.
 A. Pump shaft C. The eye
 B. The end plate D. None of the above

102. Recirculation lines are installed on some centrifugal pumps to prevent the pumps from overheating and becoming vapor bound, in case _____ or the flow of fluid is stopped for extended periods.

- A. Centrifugal force
- B. The amount of resistance to flow
- C. The discharge is entirely shut off
- D. None of the above

103. Which of the following is installed to cool the shaft and the packing, to lubricate the packing, and to seal the rotating joint between the shaft and the packing against air leakage?

- A. Water flinger rings
- B. Seal piping
- C. A lantern ring spacer
- D. None of the above

104. Which of the following is inserted between the rings of the packing in the stuffing box?

- A. Water flinger rings
- B. Seal piping
- C. A lantern ring spacer
- D. None of the above

105. Which of the following leads the liquid from the discharge side of the pump to the annular space formed by the lantern ring? The web of the ring is perforated so that the water can flow in either direction along the shaft (between the shaft and the packing).

- A. Water flinger rings
- B. Seal piping
- C. A lantern ring spacer
- D. None of the above

106. Which of the following may be fitted on the shaft between the packing gland and the pump bearing housing.

- A. Water flinger rings
- B. Seal piping
- C. A lantern ring spacer
- D. None of the above

107. Which of the following prevent water in the stuffing box from flowing along the shaft and entering the bearing housing?

- A. Water flinger rings
- B. Seal piping
- C. A lantern ring spacer
- D. None of the above

Generation of Centrifugal Force

108. When the impeller rotates, it spins the liquid sitting in the cavities between the vanes outward and provides _____.

- A. Centrifugal force
- B. Centrifugal acceleration
- C. System pressure or head
- D. None of the above

109. As liquid leaves the eye of the impeller a _____ area is created causing more liquid to flow toward the inlet.

- A. Centrifugal force
- B. Low-pressure
- C. System pressure or head
- D. None of the above

110. Because the impeller blades are curved, the fluid is pushed in a _____ direction by the centrifugal force. This force acting inside the pump is the same one that keeps water inside a bucket that is rotating at the end of a string.

- A. Centrifugal force
- B. Centrifugal acceleration
- C. Tangential and radial
- D. None of the above

Flow Rate and Pressure Head

111. The two types of pumps behave very differently regarding pressure head and flow rate: The centrifugal pump has varying flow depending on the _____.

- A. Centrifugal force
- B. Centrifugal acceleration
- C. System pressure or head
- D. None of the above

112. The positive displacement pump has _____ regardless of the system pressure or head.

- A. Centrifugal force
- B. Centrifugal acceleration
- C. More or less a constant flow
- D. None of the above

113. Positive Displacement pumps generally gives more _____ than centrifugal pumps.

- A. Centrifugal force
- B. Centrifugal acceleration
- C. Pressure
- D. None of the above

114. Which of the following indicates the losses due to friction are factored into the performance. The following terms are usually used when referring to lift or head?

- A. Dynamic
- B. Static
- C. Suction
- D. None of the above

115. Which of the following indicates the vertical distance from the water line to the centerline of the impeller?

- A. Dynamic
- B. Static Discharge Head
- C. Static Suction Lift
- D. None of the above

116. Depending on how the measurement is taken _____ and head may also be referred to as static or dynamic.

- A. Dynamic
- B. Static Discharge Head
- C. Suction Lift
- D. None of the above

117. Which of the following indicates the measurement does not take into account the friction caused by water moving through the hose or pipes?

- A. Dynamic
- B. Static
- C. Suction
- D. None of the above

118. Which of the following indicates the vertical distance from the discharge outlet to the point of discharge or liquid level when discharging into the bottom of a water tank?

- A. Dynamic
- B. Static Discharge Head
- C. Static Suction Lift
- D. None of the above

Mechanical Efficiency

119. The pumps behaves different considering mechanical efficiency as well. Changing the system pressure or head has little or no effect on the flow rate in the _____.

- A. Centrifugal pump
- B. Vertical turbine
- C. Positive displacement pump
- D. None of the above

120. Changing the system pressure or head has a dramatic effect on the flow rate in the _____.

- A. Centrifugal pump
- B. Vertical turbine
- C. Positive displacement pump
- D. None of the above

Net Positive Suction Head - NPSH

121. In a _____, NPSH varies as a function of flow determined by speed. Reducing the speed of the positive displacement pump reduces the NPSH.

- A. Centrifugal pump
- C. Positive displacement pump
- B. Vertical turbine
- D. None of the above

Understanding Progressing Cavity Pump Theory

122. Progressing cavity pumps (PCPs) are a special type of rotary _____ where the produced fluid is displaced axially at a constant rate.

- A. Centrifugal pump
- C. Positive displacement pump
- B. Vertical turbine
- D. None of the above

123. Progressing cavity pumps are comprised of two helicoidal gears (rotor and stator), where the rotor is positioned inside the _____. The combination of rotational movement and geometry of the rotor inside the stator results in the formation of cavities that move axially from pump suction to pump discharge.

- A. Rotor(s)
- C. Elastomer
- B. Stator(s)
- D. None of the above

124. Which of the following are typically machined from high-strength steel and then coated with a wear resistant material to resist abrasion and reduce stator/rotor friction?

- A. Rotor(s)
- C. Elastomer
- B. Stator(s)
- D. None of the above

125. Which of the following consist of steel tubular with an elastomer core bonded to the steel?

- A. Rotor(s)
- C. Elastomer
- B. Stator(s)
- D. None of the above

126. Which of the following is molded into the shape of an internal helix to match the rotor?

- A. Rotor(s)
- C. Elastomer
- B. Stator(s)
- D. None of the above

127. Which of the following are fundamentally fixed flow rate pumps, like piston pumps and peristaltic pumps, and this type of pump needs a fundamentally different understanding to the types of pumps to which people are more commonly first introduced, namely ones that can be thought of as generating pressure?

- A. Fixed flow rate pump(s)
- C. Positive displacement pump(s)
- B. Progressive cavity pump(s)
- D. None of the above

128. At the points where the rotor touches the stator, the surfaces are generally traveling transversely, so small areas of sliding contact occur. These areas need to be lubricated by the fluid being pumped (Hydrodynamic lubrication). This can mean that more torque is required for starting, and if allowed to operate without fluid, called 'run dry', rapid deterioration of the _____ can result.

- A. Rotor(s)
- C. Elastomer
- B. Stator(s)
- D. None of the above

129. Which of the following offer long life and reliable service transporting thick or lumpy substances?

- A. Fixed flow rate pump(s)
- C. Positive displacement pump(s)
- B. Progressive cavity pump(s)
- D. None of the above

Helical Rotor and a Twin Helix

130. Which of the following consists of a helical rotor and a twin helix, twice the wavelength and double the diameter helical hole in a rubber stator? The rotor seals tightly against the rubber stator as it rotates, forming a set of fixed-size cavities in between.

- A. Fixed flow rate pump(s)
- B. Progressive cavity pump(s)
- C. Positive displacement pump(s)
- D. None of the above

131. The cavities move when the _____ is rotated but their shape or volume does not change. The pumped material is moved inside the cavities.

- A. Rotor(s)
- B. Stator(s)
- C. Elastomer
- D. None of the above

132. The principle of this pumping technique is due to the _____, like a piston pump, and so has similar operational characteristics, such as being able to pump at extremely low rates, even to high pressure, revealing the effect to be purely positive displacement.

- A. Rotor(s)
- B. Stator(s)
- C. Sealed cavities
- D. None of the above

133. Which of the following is rotated, it rolls around the inside surface of the hole. The motion of the rotor is the same as the smaller gears of a planetary gears system?

- A. Rotor(s)
- B. Stator(s)
- C. Hypocycloid
- D. None of the above

134. As the rotor simultaneously rotates and moves around, the combined motion of the eccentrically mounted drive shaft is in the form of a _____.

- A. Rotor(s)
- B. Stator(s)
- C. Hypocycloid
- D. None of the above

135. In the typical case of single-helix rotor and double-helix stator, the hypocycloid is just a straight line. The _____ must be driven through a set of universal joints or other mechanisms to allow for the movement.

- A. Rotor(s)
- B. Stator(s)
- C. Hypocycloid
- D. None of the above

136. The elastomer core of the stator forms the _____. The rotor is held against the inside surface of the stator by angled link arms, bearings (immersed in the fluid) allowing it to roll around the inner surface (un-driven).

- A. Required complex cavities
- B. Stator(s)
- C. Elastomer
- D. None of the above

Elastomer

137. Elastomer is used for the stator to simplify the creation of the _____, created by means of casting, which also improves the quality and longevity of the seals by progressively swelling due to absorption of water and/or other common constituents of pumped fluids.

- A. Complex internal shape
- B. Stator(s)
- C. Elastomer
- D. None of the above

Vapor Pressure and Cavitation Sub-Section

138. Cavitation is the formation and then immediate implosion of cavities in a liquid – i.e. small liquid-free zones ("bubbles") – that are the consequence of forces acting upon the liquid. It usually occurs when a liquid is subjected to _____ that cause the formation of cavities where the pressure is relatively low.

- A. Cyclic stress
- B. Cavitation
- C. Rapid changes of pressure
- D. None of the above

139. Cavitation is a significant cause of wear in some engineering contexts. When entering high pressure areas, cavitation bubbles that implode on a metal surface cause _____. These results in surface fatigue of the metal causing a type of wear also called "cavitation".

- A. Cyclic stress
- B. Cavitation
- C. The formation of cavities
- D. None of the above

140. Which of the following is usually divided into two classes of behavior: inertial (or transient) cavitation and non-inertial cavitation?

- A. Cyclic stress
- B. Cavitation
- C. The formation of cavities
- D. None of the above

Inertial Cavitation

141. Inertial cavitation is the process where a void or bubble in a liquid rapidly collapses, producing _____.

- A. An acoustic field
- B. An undesirable phenomenon
- C. A shock wave
- D. None of the above

Non-Inertial Cavitation

142. Non-inertial cavitation is the process in which a bubble in a fluid is forced to oscillate in size or shape due to some form of energy input, such as _____.

- A. An acoustic field
- B. An undesirable phenomenon
- C. A shock wave
- D. None of the above

143. Since the shock waves formed by cavitation are strong enough to significantly damage moving parts, cavitation is usually _____. It is specifically avoided in the design of machines such as turbines or propellers, and eliminating cavitation is a major field in the study of fluid dynamics.

- A. An acoustic field
- B. An undesirable phenomenon
- C. A shock wave
- D. None of the above

144. To understand _____, you must first understand vapor pressure. Vapor pressure is the pressure required to boil a liquid at a given temperature.

- A. Cavitation
- B. Vapor pressure
- C. Vapor bubbles
- D. None of the above

145. Temperature affects _____ as well, raises the water's temperature to 212°F and the vapors are released because at that increased temperature the vapor pressure is greater than the atmospheric pressure.

- A. Pump cavitation
- B. Vapor pressure
- C. Vapor bubbles
- D. None of the above

146. Pump cavitation occurs when the pressure in the pump inlet drops below the vapor pressure of the liquid. _____ form at the inlet of the pump and are moved to the discharge of the pump where they collapse, often taking small pieces of the pump with them.
- A. Pump cavitation C. Vapor bubbles
B. Vapor pressure D. None of the above

Maintenance of a Vertical Turbine Pump

147. A periodic inspection is recommended as the best means of preventing breakdown and keeping maintenance costs to a minimum.
- A. True B. False
148. A periodic monthly inspection is suggested for all units. During this inspection the pump and driver should be checked for performance, change in noise or vibration level, loose bolts or piping, dirt and corrosion. Clean and re-paint all areas that are rusted or corroded.
- A. True B. False
149. Maintenance personnel should look over the whole installation with a critical eye each time the pump is inspected -- a change in noise level, amplitude of vibration, or performance can be an indication of impending trouble.
- A. True B. False
150. Any deviation in performance or operation from what is expected can be traced to some specific cause. Determination of the cause of any misperformance or improper operation is essential to the correction of the trouble -- whether the correction is done by the user, the dealer or reported back to the factory.
- A. True B. False
151. Ordinarily impellers will not require readjustment if properly set at initial installation. Almost no change in performance can be obtained by minor adjustment of enclosed impellers. All adjustments of the impellers will change the mechanical seal setting. It is recommended that the seal be loosened from the shaft until the adjustment is complete and then reset.
- A. True B. False
152. Other than the stuffing box lubrication, mechanical seal, and/or lineshaft lubrication, the pump will not require further periodic lubrication.
- A. True B. False
153. On water pumps and sumps, the suction bearing on the bowl assembly should be repacked when repairs are made, however, no attempt should be made to repack until repairs to the bowl assembly are necessary. Pumps that pump hydrocarbons or have carbon or rubber bearings do not have the suction bearing packed.
- A. True B. False
154. Maintenance of the stuffing box will consist of greasing the box when required, tightening the packing gland occasionally as the leakage becomes excessive, and installing new packing rings or sets as required.
- A. True B. False

155. Remove gland and all old packing. If the box contains a lantern ring remove this and all packing below it using two long threaded machine screws. Inspect shaft or sleeve for score marks or rough spots. Be sure by-pass holes (if supplied) are not plugged.
A. True B. False

Pump Operation & Performance Section

156. The rate of flow and total head at which the pump efficiency is maximum at a given speed and impeller diameter.

- A. Specific Speed C. Displacement
B. Best Efficiency Point D. None of the above

157. For a positive displacement pump, it is the theoretical volume per revolution of the pump shaft. Calculation methods and terminology may differ between different types of positive displacement pumps.

- A. Specific Speed C. Displacement
B. Best Efficiency Point D. None of the above

158. Which of the following is the total volume throughput per unit of time at suction conditions? The term capacity is also used.

- A. Viscosity C. Rate of Flow
B. Displacement D. None of the above

159. A measure of a liquid's resistance to flow. i.e.: how thick it is. The viscosity determines the type of pump used, the speed it can run at, and with gear pumps, the internal clearances required.

- A. Viscosity C. Rate of Flow
B. Displacement D. None of the above

160. A number represents the function of pump flow, head, efficiency etc. Not used in day to day pump selection, but very useful, as pumps with similar specific speed will have similar shaped curves, similar efficiency / NPSH / solids handling characteristics is known as?

- A. Specific Speed C. Displacement
B. Best Efficiency Point D. None of the above

161. Which of the following is an index of pump suction operating characteristics? It is determined at the BEP rate of flow with the maximum diameter impeller.

- A. Suction Specific Speed C. Friction Loss
B. Vapor Pressure D. None of the above

162. Which of the following is an indicator of the net positive suction head required [NPSH₃] for given values of capacity and also provides an assessment of a pump's susceptibility to internal recirculation?

- A. Suction Specific Speed C. Friction Loss
B. Vapor Pressure D. None of the above

163. If the vapor pressure of a liquid is greater than the surrounding air pressure, the liquid will boil.

- A. Suction Specific Speed C. Friction Loss
B. Vapor Pressure D. None of the above

164. The amount of pressure / head required to 'force' liquid through pipe and fittings.

- A. Suction Specific Speed C. Friction Loss
B. Vapor Pressure D. None of the above

165. Which of the following is the expression of the energy content of a liquid in reference to an arbitrary datum? It is expressed in units of energy per unit weight of liquid. The measuring unit for head is meters (feet) of liquid.
- A. Head C. Head, Friction
 B. Head, Friction D. None of the above
166. The head required to overcome the friction at the interior surface of a conductor and between fluid particles in motion. It varies with flow, size, type, and conditions of conductors and fittings, and the fluid characteristics.
- A. Head C. Head, Friction
 B. Head, Friction D. None of the above
167. The height of a column or body of fluid above a given point.
- A. Head, Static C. Head, Friction
 B. Head, Friction D. None of the above
168. This is the measure of energy increase, per unit weight of liquid, imparted to the liquid by the pump, and is the difference between total discharge head and total suction head.
- A. Head, Total C. Head, Friction
 B. Head, Friction D. None of the above
169. The portion of the pump that includes the impeller chamber and volute diffuser.
- A. Diffuser C. Casing
 B. Inducer D. None of the above
170. A piece, adjacent to the impeller exit, which has multiple passages of increasing area for converting velocity to pressure.
- A. Diffuser C. Casing
 B. Inducer D. None of the above
171. A single-stage axial flow helix installed in the suction eye of an impeller to lower the NPSHR.
- A. Diffuser C. Casing
 B. Inducer D. None of the above
172. The bladed member of a rotating assembly of the pump which imparts the principal force to the liquid pumped.
- A. Impeller C. Casing
 B. Inducer D. None of the above
173. The pump casing for a centrifugal type of pump, typically spiral or circular in shape.
- A. Impeller C. Casing
 B. Volute D. None of the above
174. Which of the following is related to how much suction lift a pump can achieve by creating a partial vacuum?
- A. NPSH C. NPSH3
 B. NPSHR D. None of the above

175. Which of the following is determined by the conditions of the installation and is the total suction head of liquid absolute, determined at the first-stage impeller datum minus the absolute vapor pressure in meters (feet) of the liquid at a specific rate of flow expressed in meters (feet) of liquid?

- A. NPSHA C. NPSH3
- B. NPSHR D. None of the above

176. Which of the following is the minimum NPSH given by the manufacturer/supplier for a pump achieving a specified performance at the specified capacity, speed, and pumped liquid?

- A. NPSH C. NPSH3
- B. NPSHR D. None of the above

177. For rotodynamic pumps _____ is defined as the value of NPSHR at which the first-stage total head drops by 3% due to cavitation.

- A. NPSH7 C. NPSH3
- B. NPSH5 D. None of the above

Pump Efficiency

178. Which of the following is the Static Discharge Head plus the friction in the discharge line, also referred to as Total Discharge Head?

- A. Dynamic Discharge Head C. Total Dynamic Head
- B. Dynamic Suction Head D. None of the above

179. Which of the following is the Dynamic Suction Head plus the Dynamic Discharge Head, also referred to as Total Head?

- A. Static Suction Lift C. Total Dynamic Head
- B. Dynamic Suction Head D. None of the above

180. Which of the following indicates that losses due to friction are factored into the performance?

- A. Dynamic C. Thermodynamic
- B. Static D. None of the above

181. Which of the following is the vertical distance from the water line to the centerline of the impeller?

- A. Static Suction Lift C. Total Dynamic Head
- B. Dynamic Suction Head D. None of the above

182. Which of the following is the vertical distance from the discharge outlet to the point of discharge or liquid level when discharging into the bottom of a water tank?

- A. Static Suction Lift C. Total Dynamic Head
- B. Static Discharge Head D. None of the above

183. Which of the following is the Static Suction Lift plus the friction in the suction line, also referred to as a Total Suction Head?

- A. Static Suction Lift C. Total Dynamic Head
- B. Dynamic Suction Head D. None of the above

184. Which of the following indicates the measurement does not take into account the friction caused by water moving through the hose or pipes?

- A. Dynamic C. Thermodynamic
- B. Static D. None of the above

185. Pump efficiencies tend to drop over time due to wear (e.g. increasing clearances as impellers reduce in size).

- A. True B. False

186. Pump efficiency is an important characteristic and pumps should be regularly tested. Thermodynamic pump testing is one method.

- A. True B. False

187. Subject on how the measurement is taken suction lift and head may also be referred to as static or dynamic.

- A. True B. False

188. When a system design includes a centrifugal pump, a critical issue in its design is matching the head loss-flow characteristic with the pump so that it operates at or close to the point of its maximum efficiency.

- A. True B. False

189. Pump efficiency is defined as the ratio of the power imparted on the fluid by the pump in relation to the power supplied to drive the pump. Its value is not fixed for a given pump; efficiency is a function of the discharge and therefore also operating head.

- A. True B. False

190. For centrifugal pumps, the efficiency tends to improve with flow rate up to a point midway through the operating range (peak efficiency) and then declines as flow rates rise further.

- A. True B. False

Specific Gravity

191. The term specific gravity compares the density of some substance to the _____.

- A. Density of water C. Systems of measure
B. Pressure D. None of the above

192. Since specific gravity is the ratio of those densities, the units of measure cancel themselves, and we end up with a whole number that is the same for all systems of measure. Therefore, the specific gravity of water is .5— regardless of the measurement system.

- A. True B. False

193. Specific gravity is important when sizing a centrifugal pump because it is indicative of the weight of the fluid and its weight will have a direct effect on the amount of _____ performed by the pump.

- A. Work C. Force
B. Pressure D. None of the above

194. One of the beauties of the centrifugal pump is that the head (in feet) and flow it produces has nothing to do with the weight of the liquid. It is all about the velocity that is added by the impeller. The simplest way to prove the validity of this statement is to use the _____.

- A. Falling body equation C. Pump curve
B. Law of Pascal D. None of the above

Understanding Pump Viscosity

195. When to use a centrifugal or a Positive Displacement pump (“PD Pump”) is always a clear choice. To make a good choice between these pump types it is important to understand that these two types of pumps behave very summarily.

- A. True
- B. False

196. The density of a substance is defined as its force per unit mass, but here on the earth's surface, we can substitute weight for volume.

- A. True
- B. False

197. At 39-deg F (4-deg C), water has a density of 7.84 pounds per gallon or 56.43 pounds per cubic foot.

- A. True
- B. False

Understanding Suction Lift

198. Suction lift deals with the maximum distance to the intake of a pump. Fire pumps and others may lift about _____ of suction.

- A. 33.9
- B. 5' to 10'
- C. 3 -5
- D. None of the above

Suction Limitations

199. Regardless of the extent of the vacuum, water can only be “lifted” a set distance or height due to its' _____.

- A. Atmospheric pressure
- B. Vaporization pressure
- C. Suction lift
- D. None of the above

200. Which of the following exists when a liquid is taken from an open tank to an atmospheric tank where the liquid level is below the centerline of the pump suction.

- A. Suction Lift
- B. Dynamic Suction Lift
- C. Total Dynamic Suction Lift
- D. None of the above