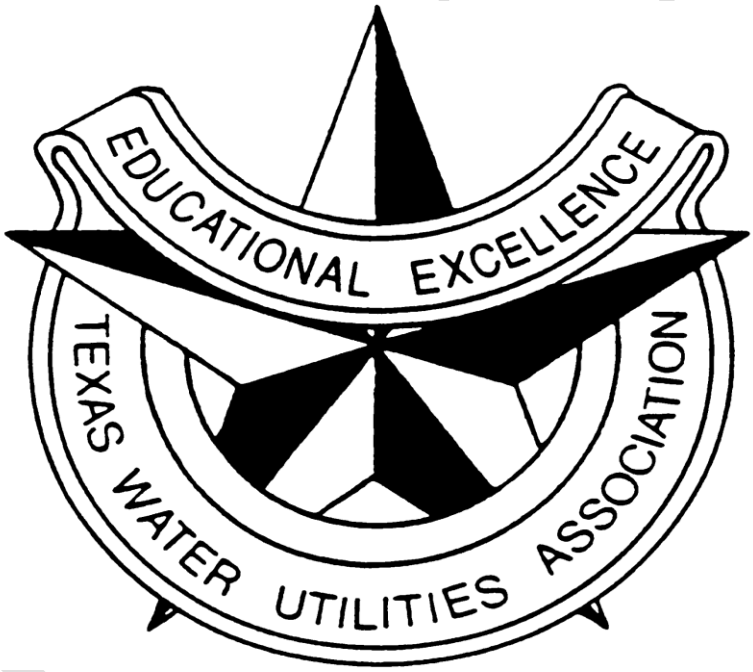
Water Operator

Study Material



Test Questions Made Possible By TWUA
Answer Key Available For TWUA Members – Contact d.moore@twua.org

The following study questions were developed to assist the operator in the preparation process for taking a state licensing exam. While we feel the questions provide a broad sample of the type of questions one might expect on the state exam. TWUA and staff in no way implies, guarantees, or suggests that an operator who uses, studies, or knows the following material will pass the state exam. The following is only intended to offer an additional study tool.

While TWUA and staff have proofed the questions and answers. It is possible however that some of the answers could be found in conflict with written materials. If you doubt or question the answer key PLEASE refer to written materials and use the answer that YOU feel best fits the question.

We hope that you will find this study guide useful and we wish you the best of luck on your state exam.

Math Equivalents

5,280 feet = 1 mile

1,760 yards = 1 mile

1 Cubic Foot of water = 1,728 Cubic inches

1 Cubic Foot of water contains 7.48 Gallons & weighs 62.4 pounds

1 Gallon of water weighs = 8.34 pounds

1 Gallon of water contains 3.785 Liters or 3,785 Milliliters

1 Liter = 1,000 Milliliters

1 Day = 24 hours – 1,440 Minutes – 86,400 Seconds

1 Million Gallons Per Day=694 Gallons Per Minute=1.545 Feet (cubed) per Second

1 Milligram per Liter = 1 Part Per Million

1 PSI = 2.31 Feet

1 Foot of Water in a column = .433 psi

1 Horsepower = .747 Kilowatts and 33,000 ft. lbs. per minute

1 Kilowatt = 1.34 Horsepower

pi = 3.1416

For Calculation Purposes assume 3.5 Persons to every Single Family Dwelling

For Calculations Purposes assume 130 Gallons Per / Capita Per Day / for Average Daily Flow.

Texas Natural Resource Conservation Commission (TNRCC) = Texas Commission on Environmental Quality (TCEQ)

Water Questions

1. What is the name of the State Agency responsible for enforcing the Safe Drinking Water Program in Texas?
    a. Texas Water Development Board
    b. Texas Department of Water Resources
    c. Texas Section of EPA
    d. Texas Water Resource and Conservation Commission
    e. Texas Commission on Environmental Quality

2. What minerals cause water hardness?
    a. Chlorine and Manganese
    b. Calcium and Magnesium
    c. Sulfates and Chlorides
    d. Carbon and Nitrogen
    e. Chlorine and Hydrogen

3. A public water system must at all times provide -
    a. Adequate quantity of water
    b. Adequate water pressure
    c. Adequate Disinfection
    d. All of the Above
    e. Only a & c

4. A source of Groundwater would be -
    a. Aquifer
    b. River
    c. Lake
    d. Stream
    e. Reservoir

5. Fecal Coliform organisms sometimes found in water supplies are an indication that –
    a. The Water supply is contaminated
    b. Harmful bacteria may be present
    c. Possible pathogenic organisms are in the water
    d. The water is unsuitable for drinking
    e. All the above

6. A disease that May be spread by inadequately disinfected water is -
    a. Acquired Immune Deficiency
    b. Polio
    c. Smallpox
    d. Dysentery
    e. All the above

7. A common chemical used in the disinfection of a small water supply is -
    a. Bromine
    b. Fluoride
    c. Sodium Hydroxide
    d. Sodium Benzene
    e. Calcium Hypochlorite

8. A physical connection between a potable water supple and a house well would be –
    a. Acceptable in Arkansas & Oklahoma
    b. A Cross Connection
    c. Considered a back up for the potable system
    d. Unaccounted for water
    e. A Class C Misdemeanor

9. The amount of Chlorine in mg/L that is used up by reacting with iron, organics, or bacteria is called?
    a. Demand
    b. Disinfection
    c. Treatment
    d. Dosage
    e. Residual

10. Which of the following is a Physical characteristic of Chlorine Gas?
    a. Greenish Yellow color
    b. Heavier than air
    c. Pungent, Penetrating odor
    d. Corrosive
    e. All The above

11. Which of the following would be considered a part of a hypo-chlorinator system?
    a. Solution feed pump
    b. Scale
    c. Rotameter
    d. 150 lb. Cylinder
    e. All the above

12. According to state requirements, all public water supply wells should be provided with a raised concrete sealing block, screened vents and –
    a. Foot valve
    b. Double check valve
    c. Flow measuring device
    d. Air gauge for verifying drawdown
    e. Emergency Shut off and lock out device

13. The drawdown of a water well is determined by -
    a. An air line
    b. An electronic sensor
    c. An in line flow meter
    d. The difference in static and pumping levels
    e. Monitoring the discharge pressure gauge & timing pump cycles

14. The pH of water indicates -
    a. If it is more acidic or base
    b. If the water is considered hard
    c. If the water is considered soft
    d. How much fluoride is naturally occurring in the water
    e. Not important in potable water treatment

15. The pH of water is expressed by a scale of numbers ranging from -
    a. 0 – 14
    b. 0 – 7
    c. 7 – 21
    d. 7.48 – 14.96
    e. 2.31 – 8.34

16. Water that is considered neutral is expressed on the pH scale at -
    a. 0.00
    b. 14.0
    c. 7.0
    d. 0.7
    e. 0.07

17. Which of the following is a required step in collecting a routine distribution sample for bacteriological testing?
    a. Use of an approved, sterile sample container
    b. Use of a sample site close to the storage tank
    c. Rinse out the sample container before collecting the sample
    d. Fill the sample container to at least 50 % of capacity
    e. Al the above

18. Sand filtration will remove which of the following from surface waste?

    a. Taste and Odor
    b. Hardness
    c. Turbidity
    d. Nitrates
    e. All the above

19. Activated Carbon is used in a Surface Water Plant primarily for?
    a. Disinfection
    b. Algae Control
    c. To Break Up Mudballs
    d. Taste and Odor control
    e. Combat Hardness

20. Which of the following chemical(s) are commonly used as coagulants in surface water treatment?
    a. Copper Sulfate
    b. Alum and Ferric Chloride
    c. Sodium Bicarbonate
    d. Soda Ash
    e. a, c, & d

21. Ground storage tanks are required to be provide with which of the following -
    a. Screened Vents
    b. An approved locking roof hatch
    c. An overflow pipe with hinged flap device
    d. Annual inspection and maintenance as needed
    e. All the above.

22. An elevated storage tank should be protected against corrosion by -
    a. Painting
    b. Cathodic protection
    c. Water stabilization
    d. All the above
    e. Only using galvanized & lead based primed components

23. A public water supply system should maintain residual pressure of 20 psi and a minimum normal operating pressure of -
    a. 35 psi
    b. 40 psi
    c. 45 psi
    d. None of the above
    e. No rule exists regarding minimum operating pressure

24. Before a new or repaired water line is placed into service, it must be properly disinfected by providing a chlorine dosage of _____ and proper detention time.
    a. 20 mg/L
    b. 30 mg/L
    c. 40 mg/L
    d. 50 mg/L
    e. Currently there is no mandated standard or requirement

25. Water bearing formations beneath the earth's surface that are used as a source of water for public water supplies are -
    a. Artesian wells
    b. Aquifers
    c. Water sheds
    d. Impervious formations
    e. Hydrologic anomalies

26. The purpose of an air line on a well is -
    a. Aerate the water in the bottom of the well
    b. Determine the depth to the aquifer
    c. Determine water levels in the well
    d. Inject chlorine for disinfection purposes
    e. Allow the well to breath & function properly

27. The mesh size is an important feature of a well screen because properly sized openings should -
    a. Reduce the amount of sand pumped
    b. Increase the water velocity through the screen
    c. Eliminate the need for gravel packing
    d. Eliminate over pumping
    e. All the above

28. When treating surface water, the process of coagulation will be most affected by the –
    a. Type and quantity of alum and ferrous sulfate used
    b. Amount of mixing and sedimentation time
    c. pH, alkalinity, temperature, and chemical dosage
    d. Plant design and age of equipment
    e. Quality of raw water (influent)

29. A rapid sand filter should be backwashed when -
    a. Shift changes
    b. A specified by the design engineer or every 100 hours
    c. When sand compaction is between 30 % and 50 %
    d. When mudballs and turbidity gets high on the discharge side
    e. When the loss of head gauge indicated between 6 and 10 ft.

30. Which of the following is an acceptable disinfection residual at the far reaches of the distribution system -
    a. 0.2 mg/L free chlorine residual
    b. 0.5 mg/L chloramine residual for a surface water supply.
    c. 0.8 mg/L chloramine residual when using chloramine treatment
    d. 0.5 mg/L free chlorine residual for a groundwater supply
    e. All the above

31. What is the approximate total volume of a circular tank in gallons, if it is 30 feet in diameter, and is 15 feet deep –
    a. 5,284
    b. 10,597
    c. 15,854
    d. 42,390
    e. 79,300

***Hint*: pi X radius X radius X depth X cubic foot of water equivalent**

32. You are setting a chlorinator to provide a dosage of 4.0 mg/L. If the daily water usage is 750,000 gallons, the gas chlorinator feed rate should be set at _____ pounds per day.
    a. 3
    b. 12
    c. 16
    d. 25
    e. 52

33. One gallon of water weighs -
    a. 2.31 lbs.
    b. 7.48 lbs
    c. 8.43 lbs
    d. 8.34 lbs
    e. None of the above

34. One foot of water inside a storage vessel will raise a pressure gauge at the bottom of the vessel by –
    a. 2.31 lbs
    b. 43.3 lbs
    c. .433 lbs
    d. 27.3 lbs
    e. 8.34 lbs

35. A raw water intake structure may not be constructed with _____ feet of a boat ramp, dock, or marina
    a. 10 feet
    b. 100 feet
    c. 1,000 feet
    d. 10,000 feet
    e. There are no current state restrictions

36. Common type(s) of pump(s) for use in water wells are -
    a. Centrifugal
    b. Split Case
    c. Vertical Turbine
    d. Submersible
    e. Both c & d

37. _____ is the natural exchange of water between the earth and air
    a. Transportation Cycle
    b. Precipitation Cycle
    c. Hydrological Cycle
    d. Universal Cycle
    e. All of the above

38. If and when a health hazard contamination event occurs in a public water System, the operator must contact the state regulatory authority within _____ hours by telephone.
    a. 8 working hours
    b. 24 hours
    c. 48 hours
    d. 72 hours
    e. When the supervisor returns and verifies the event

39. Potable water is that of -
    a. Maintained at adequate pressure
    b. Pathogen free
    c. Contains a chlorine residual
    d. All the above
    e. Both B & C

40. Excessive nitrates in drinking water can cause a condition that affects infants under the age of 6 months. This condition is known as –
    a. Shaken baby
    b. Crying baby
    c. Blue babies
    d. Hypoxia
    e. Condition does not exist – only a myth

41. In surface water treatment the process of causing the fine particles in the water to join together to form larger heavier particles that settle in a clarifier is called -
    a. Clarification
    b. Treatment
    c. Detention Time
    d. Clotting
    e. Coagulation

42. The test commonly used to determine the chemical dosage for the surface water plant is the _____ test.
    a. BOD test
    b. pH test
    c. Dissolved oxygen test
    d. Jar test
    e. Both a & b

43. Suspended solids are the solids portion that –
    a. Cause hardness
    b. Cause air bubbles
    c. Cannot be filtered out
    d. Can be filtered with additional treatment
    e. Cause mudballs & filter plugging

44. A public water system is required to take samples of water for bacteriological analysis. The organism that is used as an indicator is called -
    a. Chloroform
    b. Coliform
    c. Chloramines
    d. Parasite
    e. Amoeba

45. Chlorine dosage is demand plus desired _____.
    a. Residue
    b. Residual
    c. Demand
    d. Treatment
    e. Both b & c

46. A storage vessel that is the same diameter from the ground to the top and Is more than 20 feet but less than 80 feet tall is called a –
    a. Elevated storage
    b. Ground storage
    c. Spherical storage
    d. Stand pipe
    e. Useless device

47. Potable water must be stored at an elevation at least 80.85 feet above the highest known connection to provide the minimum operating pressure of _____ psi.
    a. 20 psi
    b. 25 psi
    c. 30 psi
    d. 35 psi
    e. 40 psi

48. A water tank that uses compressed air over water to provide pressure is called a -
    a. Sand pressure filter
    b. Bladder tank
    c. Boiler
    d. Hydro pneumatic tank
    e. Health hazard and should be removed

49. According to the lead and copper rule, pipe and fittings may not contain more than _____ lead or solder and flux may not contain more than 0.2 % lead.
    a. 0.8 %
    b. 8.0 %
    c. 2.0 %
    d. 20 %
    e. None of the above

50. When testing for chlorine residual DPD is used as an indicator, when DPD is added to water containing chlorine what color does the sample turn?
    a. Blue
    b. Red
    c. Green
    d. Yellow
    e. There should be no change in color

51. The most commonly used valve(s) used for isolating a water leak is the _____ valve.
    a. Ball valve
    b. Butterfly valve
    c. Check valve
    d. Gate valve
    e. Pressure reducing valve

52. In the distribution system when a valve or hydrant is opened or closed too fast it could result in a –
    a. Pressure drop
    b. Water hammer
    c. Cross connection
    d. Contamination
    e. No change – this task is routinely preformed

53. The most commonly used pump in the distribution system is –
    a. Centrifugal
    b. Positive displacement
    c. Roller pump
    d. Submersible
    e. Hollow shaft turbine

54. You are treating 21 MGD water in a surface water plant, how many gallons per minute is this?
    a. 1,458
    b. 5,833
    c. 8,750
    d. 14,583
    e. 87,500

55. A Texas Class D Certified Operator can operate a public water system up to _____ connections
    a. 250
    b. 275
    c. 500
    d. 1,000
    e. 2,500

56. All state of Texas Operator License's after issue are good for _____ years.
    a. 2 years
    b. 3 years
    c. 4 years
    d. A lifetime
    e. None of the above

57. After analyzing monthly bacteriological samples the operator is notified that one testing point, tested positive. The operator should –
    a. Not be concerned because the other samples were good
    b. Collect another sample at the site that tested positive & re-submit
    c. Collect another sample at the site that tested positive plus one within five customers upstream and one with five customers downstream & re-submit
    d. Locate a new lab that will do a better job analyzing samples
    e. Take no action and wait for TCEQ field inspector to direct actions

58. Any excavation greater than _____ feet in depth requires the use of OSHA approved shoring equipment or sloping of walls to prevent cave-ins.
    a. 3 feet
    b. 4 feet
    c. 5 feet
    d. 7 feet
    e. There is no accepted standard

59. If an operator discovers a chlorine leak on a 150 lb. cylinder inside a room he / she should immediately –
    a. Call for assistance & wait
    b. Put on a self contained breathing apparatus & attach lifeline
    c. Once assistance arrives – enter the room and shut off the valve on the cylinder and wait for exhaust fan to evacuate chlorine from room.
    d. Take a deep breath and hold – quickly enter the room and shut off the valve on the cylinder.
    e. a, b, & c

60. Waterlines should be installed no closer than _____ feet to any sewer lines or other possible contaminate lines.
    a 6 feet
    b. 7 feet
    c. 8 feet
    d. 9 feet
    e. There are no recognized current standards

61. At the base of an elevated storage tank a pressure gauge reads 72 psi, how far above the gauge, is the water surface?
    a. 16.6 feet
    b. 31.1 feet
    c. 166 feet
    d. 1,663 feet
    e. Not enough information to compute

62. How many gallons of water will a storage tank that is 978 cubic feet hold?
    a. 7,315
    b. 73,150
    c. 130.7
    d. 73.1
    e. Not enough information to compute

63. Calcium Hypochlorite (HTH) is used as a disinfectant in small systems, what percentage chlorine is this material typically?
    a. 65 – 75 %
    b. 75 – 85 %
    c. 85 – 95 %
    d. 100 %
    e. 8 % - same as household bleach

64. A certified operator doing his / her routine daily checks of wells, pumps, and storage facilities discovers a cut lock on the entry gate, there is also a cut lock on the roof hatch to the storage tank and suspicious looking containers lying on the ground that does not belong. What should the operator do?
    a. Immediately notify TCEQ Regional Office & they will notify law enforcement and investigate to determine if there is a danger or threat to public health and safety.
    b. Pull the electrical disconnect on the pumps and close valves isolating the tank until it can be analyzed.
    c. Disregard findings as a harmless kids prank
    d. Evacuate the town because terrorist have comprised the water supply
    e. Both a & b

65. When calculating area, one will use the standard for pi, what is the standard accepted numerical value for pi?
    a. 3.1416
    b. 2.31
    c. 7.48
    d. .433
    e. Not important to know since it is on most calculators

66. Flushing dead-end mains – current state regulations require that all public water systems flush dead-end mains to assure chlorine residual and water quality. What is the minimum flushing requirement?
    a. Once every month
    b. Once every quarter
    c. Annually, prior to the sanitary inspection
    d. Customers on dead-in lines should be grateful to have water
    e. State has more important things to oversee and regulate

67. In small systems liquid bleach is an approved method of disinfection, provided the product used meets basic industry standards. What is the current standard bleach must meet in order to be approved for disinfection in a public water system?
    a. Registered with National Bleach Producers Association
    b. Must be approved through the National Chemical Producers Assoc.
    c. Must confirm to the National Sanitation Foundation (NSF) Standard 60
    d. Cannot use over the counter bleach for disinfection
    e. Liquid bleach must comply with Senate Bill – 3

68. The process of adding enough chlorine to a water supply to complete all reactions with reducing compounds, ammonia, and organic materials so that some free chlorine is left is called -
    a. Breakpoint chlorine
    b. Chlorine demand
    c. Chlorine dosage
    d. Residual chlorination
    e. Operator satisfaction

69. The primary reason(s) for main line failures in the distribution system is –
    a. Internal and external corrosion
    b. Defective material
    c. Lack of routine maintenance
    d. Improper backfill and lack of proper bedding
    e. Both a & d

70. Check valves on the discharge side of a pump are used to –
    a. Stop water flow in case of flooding
    b. Stop pump cavitations
    c. Assist in directing flow and velocity
    d. Prevent water from flowing back through the pump when the pump is off
    e. Check valves are never used on the discharge side of a pump

71. _____ & _____ acids are by products of drinking water chlorination
    a. Sulfuric & Muratic
    b. Amino & Citric
    c. Trihalomethanes & Haloacetic
    d. Citric & Carbonic
    e. Hydrochloric & Chloric

72. There are _____ major underground water aquifers in Texas
    a. 4
    b. 7
    c. 10
    d. 11
    e. 12

73. The most common type of filter in a surface plant is _____ and is designed to treat and flow at –

    a. Rapid Sand & Designed to flow 2 gpm/ft2
    b. Forced Pressure & Designed to flow 4 gpm/ft2
    c. Gravity Feed & Designed to flow 2 gpm/ft2
    d. Rapid Sand & Designed to flow 6 gpm/ft2
    e. Trickling filter & Designed to flow 2gpm/ft2

74. Proper backwashing of a sand filter is accomplished when the filter media expands by _____ %
    a. 25 % to 30 %
    b. 30 % to 50 %
    c. 40 % to 45 %
    d. 60 % or more
    e. None of the above

75. After disinfection and flushing of super chlorinated new lines and service but prior to placing the line into service, bacteriological samples are required. The current standard is _____ sample for every _____ feet of line.
    a. One sample for every 500 feet of line
    b. Two samples for every 1,000 feet of line
    c. One sample for every 1,000 feet of line
    d. Only one sample regardless of the length of line
    e. Not a requirement – No samples are necessary

76. For Cross Connection Control the TCEQ preferred method is –
    a. Testable Double Check Valve
    b. Reduced Pressure Zone (RPZ)
    c. Atmospheric Breaker Valve
    d. Physical Air Gap
    e. All the above

77. One microorganism in water that is resistant to chlorine is –
    a. Fecal Organisms
    b. Deoxyribonucleic acid
    c. Super Cell Amoeba
    d. Cryptosporidium
    e. Nothing is resistant to Chlorine

78. All of the following are common types of water meters except –
    a. Positive displacement
    b. Multi Jet
    c. Compound
    d. Propeller
    e. Inverted Parshall Flume

79. A “Boil Water” notice can be triggered by all the following except –
    a. Low distribution pressure
    b. Water outages
    c. Repeated unacceptable BAC-T samples
    d. Failure to maintain good Cl2 residual
    e. The mayor has concerns about water quality

80. The maximum safe withdrawal rate of chlorine for a 150-pound cylinder is -
    a. 20 lbs per 24 hours
    b. 30 lbs per 24 hours
    c. 40 lbs. per 24 hours
    d. 50 lbs per 24 hours
    e. There is no standard – draw as much as possible

81. When diluting a strong acid, always add _____ to _____, rather than the reverse.
    a. Water / Acid
    b. Acid / Base
    c. Acid / Water
    d. d. Base / Acid

82. The normal Oxygen content of the atmosphere is _____ %.
    a. 20.9
    b. 7.88
    c. 19.0
    d. 7.0

83. Any atmosphere that is less than _____ % oxygen should not be entered without an approved self-contained breathing apparatus.
    a. 20.9
    b. 16.9
    c. 19.5
    d. 21.0

84. When chlorine gas is added to water, what compounds are formed?
    a. Hydrochloric acid
    b. Hydrogen hydroxide
    c. Hypochlorous acid
    d. Both a and b

85. The most important federal law that impacts the water utility industry is?
    a. The Safe Drinking Water Act of 1974
    b. The Federal Water Standards Act of 1984
    c. The Federal Environmental Impact Assessment Act
    d. Texas Water Use Plan 2005
    e. The EPA Minimum Standards Act 1996

86. An example of a Non- Community Water System would be?
    a. RV Park
    b. Hotel / Motel
    c. Service Station
    d. a, b, & c
    e. None of the above

87. The EPA requires community water systems to provide customers with an annual?
    a. Notice of proposed rate increase
    b. Consumer Confidence Report
    c. Consumer Price Index Report
    d. Consumer Cost of Living Analysis
    e. Copy of Department Expenditure Budget

88. When designing systems engineers use a rule of thumb of _____ gallons per person per day when more accurate data not available.
    a. 100 Gallons
    b. 125 Gallons
    c. 130 Gallons
    d. 140 Gallons
    e. 150 Gallons

89. TCEQ requires community water systems to have a minimum production capacity of _____ per connection at peak demand.
    a. 0.3 gpm
    b. 0.4 gpm
    c. 0.5 gpm
    d. 0.6 gpm
    e. There is no TCEQ requirement – only a suggestion

90. The most important treatment in water is?
    a. Disinfection
    b. Fluoride Injection
    c. Filtration
    d. Organic Removal
    e. Both a & c

91. Potable water means the water is –
    a. Safe for human consume
    b. Free of disease causing organisms
    c. Has a chlorine residual
    d. a, & c only
    e. a, b, & c

92. TCEQ requires notification from the operator if changes to the public water system occur such as –
    a. Change in Water Source, Water Quality, or Health Hazards
    b. Change in Delivery Method
    c. Change in City Council
    d. Change in Population
    e. TCEQ does not require notice for changes to Public Water Systems

93. Public water Systems in Texas are required to compile and maintain reports showing –
    a. Pumpage & Chemical Used
    b. Date of Dead End Flushing & Storage tanks cleaned
    c. Microbiological tests & Chemical tests
    d. a & c only
    e. a, b, & c

94. Physical characteristics of water include –
    a. Taste & odor
    b. Taste, odor & color
    c. Taste, odor, color, turbidity, & temperature
    d. Taste, odor, color, turbidity, temperature, disinfection
    e. Taste, odor, color, turbidity, temperature, disinfection, & chemical analysis

95. Common gases found in water are hydrogen sulfide, carbon dioxide, and methane. Hydrogen sulfide can be identified by its distinct smell, which is –
    a. Sweet and kind of citrus
    b. Sour and kind of like ammonia
    c. Not detectable to the human nose
    d. Obnoxious and like rotten eggs
    e. Obnoxious and like decaying animals

96. Groundwater is generally well filtered and free of turbidity, color and organics, however it may be high in –
    a. Minerals, gases, or corrosives
    b. Hardness, suspended solids, & inorganic's
    c. Magnesium, manganese, & sulfides
    d. Calcium, iron, pesticides & herbicides
    e. Price, & used primarily for irrigation

97. Livestock and septic tanks must be no closer than _____ to a public well.
    a. 5 feet
    b. 25 feet
    c. 50 feet
    d. 500 feet
    e. 5280 feet

98. Underground fuel tanks and septic drainage fields must be at least _____ feet from a public well.
    a. 50 feet
    b. 150 feet
    c. 300 feet
    d. 500 feet
    e. 1,500 feet

99. Feedlots, sewage treatment plants and landfills must be at least _____ feet from a public well.
    a. 50 feet
    b. 150 feet
    c. 500 feet
    d. 5,000 feet
    e. 15,000 feet

100. Trenches for laying six-inch and larger pipe must be at least 18 inches wide and or _____ inches wider than the pipe diameter.
    a. 6 inches
    b. 8 inches
    c. 10 inches
    d. 12 inches
    e. 24 inches

101. The top of a pipe in a trench must be at least _____ inches from the top of the ground.
    a. 12 inches
    b. 18 inches
    c. 24 inches
    d. 36 inches
    e. Not an established minimum depth standard.

102. In an excavation _____ feet or deeper a means of exit must be provided.
    a. 3 feet
    b. 4 feet
    c. 5 feet
    d. 7 feet
    e. No current standard is in place

103. In an excavation if a ladder is used as a means of exit, it must extend _____ feet about the ground and be secured and within _____ feet laterally of anyone in the excavation.
   a. 2 feet above & 12 feet laterally
   b. 2 feet above & 50 feet laterally
   c. 3 feet above & 10 feet laterally
   d. 3 feet above & 25 feet laterally
   e. 4 feet above & 50 feet laterally

104. A groundwater system that serves in excess of 1,000 connections must have at least _____ operator(s) with _____ license to meet minimum state requirements for public water systems.
   a. 1 operator with “d” license
   b. 2 operators with “d” license
   c. 1 operator with “c” license
   d. 2 operators with “c” license
   e. 1 operator with “d” and one with “c” license

105. A groundwater well is currently pumping 1000 gallons per minute. Convert 1000 (gpm) to million gallons per day (mgd)
   a. 60,000
   b. 1.44
   c. 144
   d. 1440
   e. 2.40

106. It is desirable for the pH of treated water to be above _____, otherwise _____ conditions will exist.
   a. 6.0 & Corrosive
   b. 7.0 & Corrosive
   c. 6.0 & Alkaloid
   d. 7.0 & Alkaloid
   e. None of the above

107. Fluorides are naturally occurring in some groundwater. Fluorides in drinking water should not exceed _____ mg/L.
   a. 1.0 mg/L
   b. 2.0 mg/L
   c. 3.0 mg/L
   d. 4.0 mg/L
   e. 5.0 mg/L

108. Red water or red stains may be caused by _____ levels in the water.
   a. Calcium
   b. Nitrates
   c. Iron
   d. Lead
   e. Organic Vegetation

109. When chemicals are used at a water treatment plant, a _____ day supply should be kept on hand at all times to comply with state standards.
    a. 10
    b. 15
    c. 20
    d. 25
    e. 30

110. The presence of iron in water is most commonly treated by
    a. Adding chemicals
    b. Adding hydrofluorosilic acid
    c. Introducing DC current
    d. Aeration
    e. Sedimentation

111. A common chemical oxidizer is –
    a. Sodium chloride
    b. Sodium hydrochloride
    c. Soda ash
    d. Lime
    e. Potassium permanganate

112. If groundwater is to be treated for several problems, the first process should be –
    a. Disinfection
    b. Aeration
    c. Sedimentation
    d. Filtration
    e. Reverse osmosis

113. Excess fluoride in water may be removed by –
    a. Chlorination
    b. Aeration
    c. Activated carbon
    d. Activated alumina
    e. Both a & b

114. Trihalomethanes are formed by the reaction of _____ with organic chemicals.
    a. Free available chlorine
    b. Free available ozone
    c. Calcium hypochlorite
    d. Potassium hypochlorite
    e. Excessive detention times

115. TCEQ requires a water system to have disinfection equipment capable of proving at least _____ % greater capacity than the highest expected dosage at any time.
   a. 10 %
   b. 20 %
   c. 25 %
   d. 50 %
   e. 100 %

116. The rotometer on a gas chlorinator indicates the number of _____ of chlorine fed during a _____ period.
   a. Ounces / 12 hr.
   b. Ounces / 24 hr.
   c. Pounds / 12 hr.
   d. Pounds / 24 hr.
   e. Pounds / week

117. A dosage of 4 mg/L is added to 750,000 gallons of water. How many pounds of chlorine are needed?
   a. 10
   b. 15
   c. 20
   d. 25
   e. 30

Hint: Chlorine = MG X 8.34 X dosage (mg/L)

118. How many pounds of 70 % chlorine (HTH) will be needed to treat the same amount of water as 9.0 lbs. of 100 % chlorine?
   a. 11.85
   b. 12.85
   c. 6.3
   d. 16.3
   e. Not enough information to compute

119. Using a ton cylinder, the maximum withdrawal rate should not exceed?
   a. 40 lbs.
   b. 400 lbs.
   c. 1,000 lbs
   d. 1,760 lbs.
   e. There is no maximum withdrawal rate for ton cylinders

120. A “pinging” sound or “rocks bouncing” sound coming from the pump typically indicates the pump is _____.
   a. Over used
   b. Under used
   c. Cavitating
   d. Needing maintenance
   e. Single phasing

121. A submersible pump and motor will be –
    a. Mounted on a concrete pillar 18 inches above the floor
    b. Pump in the bottom of the well and motor at the floor
    c. Set at the static level of the well
    d. Suspended by pipe, placed near the bottom of the well
    e. Only used in wastewater applications

122. The distance from the water level in the well to the centerline of the pump is
    a. Static suction head
    b. Total static head
    c. Total static discharge head
    d. Total friction loss
    e. Determined by city engineer

123. The distance from the water level in the well to the water level in a storage tank is –
    a. Static discharge head
    b. Static suction head
    c. Total friction loss
    d. Total static head
    e. Determined by city engineer

124. The loss of energy which results from the movement of water through pipes and fittings is –
    a. Head
    b. Pressure
    c. Friction
    d. Pipe electrolysis
    e. Hydraulics

125. If a water lubricated vertical turbine pump is started with dry bearings –
    a. The pump will vibrate
    b. The bearings may wear quicker
    c. The bearing will not be effected by dry starts
    d. The bearings will be damaged
    e. Both a & b

126. Routinely measuring the static level and pumping level can –
    a. Tell the operator when to lubricate the bearings
    b. Satisfy TCEQ rules and regulations
    c. Satisfy the Texas Water Commission long range needs requirements
    d. Detect problems with the pump, well screen, and or water level
    e. Both b & c

127. The recommended capacities for ground storage is based on providing _____ to _____ hours of supply at _____ gallons per connection.
   a. 2 to 3 hours at 130 gallons per connection
   b. 4 to 6 hours at 130 gallons per connection
   c. 2 to 3 hours at 200 gallons per connection
   d. 4 to 6 hours at 200 gallons per connection
   e. 6 to 10 hours at 200 gallons per connection

128. Fire codes require water main sizes in residential areas to be at least _____ when fire hydrants are attached.
   a. 4 inch
   b. 6 inch
   c. 8 inch
   d. TCEQ requirements are primary and over ride all fire codes
   e. There is no current Fire Code requirements

129. Flows in pipes depends greatly on pipe diameter. Doubling the pipe diameter increases the carrying capacity by _____ times if friction is not considered.
   a. 2 times
   b. 3 times
   c. 4 times
   d. 5 times
   e. Doubling diameter has little effect on carrying capacity

130. Unaccounted for water loss should be less than _____ % of water production.
   a. 5 %
   b. 9 %
   c. 12 %
   d. 15 %
   e. 20 %

131. A critical factor affecting the useful life of service lines is the ability of the pipe material to resist internal and external _____.
   a. Corrosion
   b. Pressure
   c. C – factor
   d. Breakage
   e. Atmospheric influences

132. The results of bacteriological analysis shall be kept on file and available for _____ years.
   a. 2 yrs.
   b. 4 yrs.
   c. 5 yrs.
   d. 10 yrs.
   e. indefinitely

133. A well pumped for 45 days. The beginning meter reading was 7,456,400 and 45 days later the same meter reading was 15,154,400. What was the average flow in gallons per day?
    a. 121,400
    b. 171,066
    c. 254,122
    d. 421,744
    e. 567,894

134. One horsepower (1 hp) is equal to _____ feet pounds of force per minute.
    a. 5280 feet pounds
    b. 1760 feet pounds
    c. 33,000 feet pounds
    d. 33,960 feet pounds
    e. 44,449 feet pounds

135. A groundwater well is currently producing 1.4 MGD. Calculate and convert 1.4 MGD (million gallons per day) to GPM (gallons per minute)
    a. 972 gpm
    b. 1400 gpm
    c. 1440 gpm
    d. 1760 gpm
    e. 9720 gpm

136. Elevated storage is required for systems over _____ connections.
    a. 750 connections
    b. 1000 connections
    c. 1500 connections
    d. 2000 connections
    e. 2500 connections

137. Pressure Vessels (tanks) are not recommended for systems over _____ connections.
    a. 750 connections
    b. 1000 connections
    c. 1500 connections
    d. 2000 connections
    e. 2500 connections

138. Altitude valves are used to control the level of water in a _____.
    a. Ground storage tank
    b. Pressure tank
    c. Elevated storage tank
    d. Groundwater well
    e. Customer irrigation system

139. When an air gap is not practical, other acceptable backflow prevention devices are acceptable (depending upon application). All of the following devices are acceptable in certain circumstances except –
    a. Atmospheric vacuum breaker
    b. Pressure vacuum breaker
    c. Testable double check valve assemblies
    d. Reduced pressure zone devices
    e. Pressure reducing valve

140. If a new water main is installed and the total length of the new line is six (6) miles. How many bacteriological samples must be taken?
    a. 6 samples
    b. 12 samples
    c. 24 samples
    d. 32 samples
    e. 36 samples

141. In a cubic foot of water there are _____ gallons. How many gallons are there in 9 cubic feet of water?
    a. 2.31 gallons & 20.79 gallons
    b. 3.14 gallons & 28.26 gallons
    c. 7.48 gallons & 67.32 gallons
    d. 8.34 gallons & 75.06 gallons
    e. 8.43 gallons & 85.87 gallons

142. You are instructed to install 3.5 miles of 6” water line. The pipe comes in 20 ft. lengths. How many joints of pipe will you have installed once the job is complete?
    a. 725
    b. 852
    c. 900
    d. 924
    e. 942

143. A new subdivision is proposed for your community. The projected water use for this subdivision upon completion is 3.1 MGD. How many gallons per minute will that be?
    a. 1292 GPM
    b. 2152 GPM
    c. 7440 GPM
    d. 10,215 GPM
    e. Not enough information to compute

144. You are the operator of a Surface Water Treatment plant currently treating 4.3 MGD. The required dosage of Alum is 12 mg/L. How many pounds of Alum will you use in a month?
    a. 430 lbs.
    b. 1,430 lbs
    c. 12,910 lbs.
    d. 17,931 lbs.
    e. Not enough information to compute

145. Artesian wells are –
    a. Hand dug shallow wells
    b. Rotary drilled and free flowing wells
    c. Typically seen with a vertical turbine pump & motor
    d. Under the influence of lakes and streams
    e. Naturally occurring and free flowing wells

146. Federal and State laws mandate bacteriological analyses of the water supply. These samples must be obtained at least every –
    a. Week
    b. Month
    c. Quarter
    d. Year
    e. None of the above

147. The rate of speed at which water moves is –
    Pressure
    a. Velocity
    b. Viscosity
    c. Pneumatic
    d. Hydraulics

148. The unit of measure for water pressure is –
    a. GPM
    b. MGD
    c. PSI
    d. CFS
    e. LBS

149. The purpose of a thrust block is –
    a. Add to construction costs
    b. Prevent the addition of more lines
    c. Aid in the location once a line is buried
    d. Prevent movement at pipe joints
    e. Irritate workers if they ever have to dig out the line

150. The four common classes of working pressure in water main pipes are –
    a. 100 / 150 / 200 / 250
    b. 100 / 125 / 150 / 200
    c. 50 / 100 / 125 / 150
    d. 125 / 150 / 175 / 200
    e. 100 / 200 / 250 / 300

151. Volume equals length time's width time's height. Using this information if a container is 12 feet long, 4 feet wide, and 6 feet high – what is the volume of this container?
    a. 48
    b. 72
    c. 88
    d. 188
    e. 288

Hint: Length X Width X Depth

152. AWWA recommends that a 5/8 X 3/4 service meter be tested every _____ years or _____ gallons of water registered.
    a. 3 to 6 years or 1,000,000 gallons
    b. 5 to 10 years or 5,000,000 gallons
    c. 5 to 10 years or 1,500,000 gallons
    d. 7 year or 2,500,000 gallons
    e. 15 years regardless of gallons flowed through the meter

153. When pressure testing a water main, the test pressure should be –
    a. The same as normal operating pressure
    b. Twice as much as normal operating pressure
    c. 50 psi more than normal operating pressure
    d. 100 psi more than normal operating pressure
    e. 1 ½ times as great as the normal operating pressure

154. Reported water main leaks should be repaired within –
    a. 8 hours
    b. 24 hours
    c. 1 week
    d. 1 month
    e. As other duties allow

155. Scale build up in pots and pans is caused by –
    a. Chlorinated water
    b. Soft water
    c. Groundwater
    d. Surface water
    e. Hard water

156. An operator installing a corporation stop would be placing this device at –
    a. The curb
    b. On the main line and the service line is attached
    c. Just prior to the water meter
    d. On the customer side of the water meter
    e. The angle valve attached to the meter

157. The term pathogenic refers to –
    a. Pasteurized
    b. Sterile
    c. Contaminated
    d. Disease Causing
    e. None of the above

158. Calcium Hypochlorite (HTH) is corrosive and may be flammable in the presence of _____ or _____.
    a. Petroleum or Inorganic
    b. Petroleum or Organic
    c. Carbon or Distilled Minerals Spirits
    d. Bicarbonate or Soda Ash
    e. None of the above

159. You come upon an unconscious person who is unresponsive. The most important thing to check first is –
    a. The persons airway
    b. The persons pulse
    c. The persons pupils
    d. The persons wallet
    e. The persons circulatory system

160. Pathogens (disease causing organisms) can be transmitted through water, blood, or by breathing. The most obvious routes for entry into the body are
    a. Ears & Eyes
    b. Mouth & Any moist openings
    c. Cuts & Open Sores
    d. Skin exposure & Contact with an infected person
    e. None of the above

161. The letters SCBA on a cabinet would indicate to the operator –
    a. Self Contained Burn Apparatus
    b. Socially Communicable Bacteria Around
    c. Self Contained Breathing Apparatus
    d. Self Controlled Blaze Anomaly
    e. System Controlled By Authorities

162. Bacteria, Viruses, Parasites, and Fungus are –
    a. Air-Borne Pathogenic Organisms
    b. Almost eradicated by the use of chlorine
    c. Water-Borne Pathogenic Organisms
    d. Laboratory Experiments gone bad
    e. Both c & d

163. Depending on weather conditions and moisture in the air an electrical arc may jump from _____ for 110 volts to _____ for 440 volts.
    a. 3 inches for 110 volt to 3 feet for 440
    b. 4 inches for 110 volt to 4 feet for 440
    c. 6 inches for 110 volt to 6 feet for 440
    d. Meer inches for 110 volt to 6 feet for 440
    e. Electrical arch's do not happen in lower voltages

164. All Warnings Sings in temporary traffic control zones shall have –
    a. Black letters on yellow background
    b. Black letters on orange background
    c. Orange letters on Black background
    d. White letters on Red background
    e. Bold letters on an Electronic Board

165. Chemical testing of surface water sources is required every –
    a. 1 year
    b. 2 years
    c. 3 years
    d. 4 years
    e. 5 years

166. Common Surface Water coagulants are –
    a. Aluminum Sulfate
    b. Ferric Sulfate
    c. Ferric Chloride
    d. Ammonia Nitrate
    e. a, b, & c

167. The current MCL for Trihalomethanes (THM's) is –
    a. 0.8 mg/L
    b. 8.0 mg/L
    c. 80.0 mg/L
    d. 10.0 mg/L
    e. 0.05 mg/L

168. To load liquid Alum into a chemical feeder, you should use hoses or piping of –
    a. Stainless Steel
    b. Copper
    c. Galvanized Iron
    d. Plastic
    e. Alum does not come in a liquid form

169. The jar test is considered proper process control for a surface water plant and is used to determine –
    a. The Turbidity
    b. The Alkalinity
    c. The correct coagulant dosage
    d. The pH
    e. Both a & c

170. The primary MCL for Nitrate in drinking water is –
    a. 0.01 mg/L
    b. 10.0 mg/L
    c. 100 mg/L
    d. 20.0 mg/L
    e. None of the above

171. When a lake or reservoir stratifies the best water quality is found in what zone?
    a. Thermocline
    b. Hypolimnion
    c. Epilimnion
    d. Strata
    e. Both a & b

172. What factor(s) significantly affect the coagulation process –
    a. pH
    b. Turbidity
    c. Temperature
    d. Filter Backwash
    e. a, b, & c

173. A source water high in color coagulates better at a –
    a. High pH
    b. Low pH
    c. High Alkalinity
    d. Low Alkalinity
    e. Exactly neutral

174. TCEQ rules require that all Turbidimeters be calibrated every –
    a. 30 days
    b. 60 days
    c. 90 days
    d. 120 days
    e. Annually

175. When a traditional coagulant reacts with alkalinity in a raw water, what occurs?
    a. Turbidity Increases
    b. Hardness increases
    c. Taste & Odor concerns increase
    d. Floc is Formed
    e. Hardness Decreases

176. Zeta potential is –
    a. The measure of turbidity
    b. The measure of floc settling
    c. The measure of force preventing particles from joining
    d. Involved in coagulation
    e. Both c & d

177. Replacing approximately 6 inches of sand with 6 inches of anthracite coal is called _____ a filter.
    a. Modifying
    b. Capping
    c. Expanding
    d. Crowning
    e. Only used as a last resort in older treatment plants

178. The top of backwash troughs should be _____ inches above the top of the filter media.
    a. 20 to 36 inches
    b. 24 to 30 inches
    c. 24 to 36 inches
    d. 36 to 40 inches
    e. None of the above

179. If a sample for total alkalinity turns pink when phenolphthalein indicator is added, the pH of the sample is –
    a. Below 8.3
    b. Unknown without using a calibrated pH meter
    c. 8.3 or above
    d. 9.0 or above
    e. pH is not that great of a concern in surface water treatment

180. An appropriate method of removing excess fluoride from drinking water is –
    a. Aeration
    b. Adding activated alumina
    c. Reverse Osmosis
    d. Adding Chlorine
    e. Both b & c

181. Taste and Odor compounds may be oxidized by –
    a. Chlorine
    b. Ultra Violet Disinfection
    c. Ozone
    d. Aeration
    e. Both a & c

182. During photosynthesis algae produce _____ that aids in the water treatment.
    a. Carbon Dioxide
    b. Hydrogen
    c. Methane
    d. Both Carbon Dioxide & Hydrogen
    e. Oxygen

183. When someone asks about NTU they are -
    a. Asking about reporting units for turbidity
    b. Asking about Nitrates, Total Solids, & Uranium
    c. Asking about the Neo Technical Units
    d. Trying to impress the TCEQ field inspector
    e. Not Training Uniformly

184. The five (5) basic aerator designs used in water treatment are –
    a. Mechanical, Automatic, Manual, Pressure, Air over Hydraulic
    b. Spray, Cascade, Packed Tower, Diffused, Air, & Mechanical
    c. Spray, Centrifugal, High Pressure, Diffused, Droplet
    d. Squirt, Drip, Diffused, Air, Cascade
    e. Stripper, Spray, Cascade, Air, Diffused

185. The second step of flocculation is particle –
    a. Adsorption
    b. Absorption
    c. Destabilization
    d. Destruction
    e. Settle ability

186. Proper backwash of a filter leaves the filter media –
    a. Clean and Cracked
    b. Clean and Dry
    c. Clean and Non-uniform
    d. Clean and Level
    e. Fluffy and Receptive

187. A rule of thumb for sludge blanket thickness in solids contact, sludge blanket, and upflow clarifier is _____ the side wall depth.
    a. 1/3
    b. 1/4
    c. 1/5
    d. 1/2
    e. 2/3

188. Decayed natural organics most common in water are _____ acids.
    a. Humic & Fulvic
    b. Humic & Phosphoric
    c. Humic & Carbonic
    d. Carbonic & Phosphoric
    e. Carbonic & Fulvic

189. One purpose of using Chloramines in water would be?
    a. Reduce taste & odor in water
    b. Reduce ammonia in water
    c. Increase pH & aid in coagulation in water
    d. Reduce iron & hardness in water
    e. Because the engineer recommended the practice

190. Filtration options related to the Membrane Processes are?
    a. Microfiltration, Macrofiltration, Nanofiltration, & Reverse Osmosis
    b. Macrofiltration, Nanofiltration, & Reverse Osmosis
    c. Microfiltration, Ultrafiltration, Nanofiltration, & Reverse Osmosis
    d. Macrofiltration, Ultrafiltration, Nanafiltration, & Reverse Osmosis
    e. Microfiltration, Nanofiltration, & Reverse Osmosis

191. Flocculant or coagulant aids _____ flocculation when coagulants alone are not effective.
    a. Restrict
    b. Redistribute
    c. Enhance
    d. Control
    e. Direct

192. If coagulant dosage is too _____, floc formation continues past flocculation and into sedimentation. Likewise if the coagulant dosage is too _____, not enough floc will form to remove turbidity.
    a. Low / High
    b. High / Low
    c. Low / Low
    d. High / High
    e. Hot / Cold

193. Recycling is water recovery from spent backwash and sludge drainage. Recycling carries the risk of returning to the plant _____ and _____.
    a. Giardia and Cryptosporidium
    b. Trihalomethanes and Waste Sludge
    c. Supernate and Mixed Liquor
    d. Mudballs and Snails
    e. Filter Flies and Snails

194. Chlorine is the most common disinfectant used today and it reacts with certain source water organics and could form _____.
    a. Algae growth
    b. Fish Kills
    c. Trihalomethanes
    d. Unsafe Potable Drinking Water
    e. Hydrogen Sulfide Gas

195. Chloramines, chlorine dioxide, and ozone produce _____ but not _____.
    a. BBPs / HTMS
    b. Trihalomethanes (THMS) / Disinfection By Products (DBPs)
    c. Disinfection By Products (DBPs) / Trihalomethanes (THMS)
    d. Disinfected / Safe Drinking Water
    e. Filter Plugging / Approved Potable Water

196. Chlorine Dioxide (Cl02) is an unstable disinfectant and must be _____.
    a. Generated outdoors and away from human contact
    b. Generated on site and stored in approved pressure containers
    c. Special ordered from suppliers in small quantities
    d. Approved by TCEQ and registered with Homeland Security
    e. Generated on site and used immediately

197. Chlorine to Ammonia ratios of 3:1 to 5:1 produce _____.
    a. Monochloramine
    b. Chloramines
    c. Trihalomethanes
    d. Giardia and Cryptosporidium
    e. Idea conditions for floc formation

198. _____ is the most frequent cause of taste and odor problems in surface supplies.
    a. Calcium
    b. Magnesium
    c. Nitrogen
    d. Aquatic Life
    e. Algae

199. As an operator you know you have a Ground Storage Tank 40 ft. tall and 60 ft. in diameter. You also know the tank is currently at ¼ capacity and filling at the rate of 700 gpm. There is also a booster pump running emptying this same tank at the rate of 500 gpm. If conditions remain the same - How long will it take in minutes or hours to fill this tank to full?

    Hint : (Pi x r x r x h) x 7.48 gal/cubic ft X .75 = Min
    200gpm

    a. 3,170 minutes
    b. 4,276 minutes
    c. 5.28 hours
    d. 52.8 hours
    e. Both a & d

200. You are charged with the task of Chlorinating 20,000 gallons of water in a new distribution line with a dosage of 50 mg/l using 65% HTH. How many pounds of HTH will you use?

    Hint : MG x 8.34 x dose = lbs 100% chlorine/0.65 = lbs HTH

    a. 1.28 pounds
    b. 12.8 pounds
    c. 128 pounds
    d. 8.34 pounds
    e. 7.48 pounds