Small_Water_System_10-19-07

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Name: _____

Date: _____   Period: _____

1. 55M. You have a 1000 mg/L solution of Arsenic. To calibrate the instrument, you need 250 mL of a 10 mg/L solution. How many milliliters of the stock solution should be diluted to make 250 mLs?
    (A) 5.0
    (B) 10.0
    (C) 15.0
    (D) 2.5

2. G69. Venturi flowmeters use differential pressure to measure flow. The high-pressure port is located on the throat of the Venturi.
    (A) False
    (B) True

3. R26. How many years must systems keep original records on premises?
    (A) 16
    (B) 8
    (C) 12
    (D) 4

4. 19W. A properly sized and constructed well-casing vent should be _____ inches in diameter.
    (A) One (1)
    (B) Ten (10)
    (C) Three (3)
    (D) Six (6)

5. 64M. How many lbs of chlorine gas are required to treat 4,000,000 gal of water at a dosage of 2 mg/l?
    (A) 61
    (B) 67
    (C) 65
    (D) 69

6. 93MP. When working in an area with two or more floor coverings (for example, grating and checker-plate), be sure that they are always _____.
    (A) Separated from one another
    (B) Overlapping one another
    (C) At the entrances and exits only
    (D) Secured together

7. G73. The term slaking refers to
    (A) The addition of water to quick lime
    (B) The production of a lime slurry of calcium hydroxide
    (C) The addition of water to recalcined lime
    (D) All of these answers are correct
    (E) None of these answers are correct

8. 76M. A test on a water supply showed a hardness of 232 mg/L. A certain dosage of polyphosphates will theoretically reduce this hardness by 21 percent. What should the water hardness be after treatment?
    (A) 49 mg/L
    (B) 211 mg/L
    (C) 174 mg/L
    (D) 183 mg/L

9. 52W. Gas stations may contribute these materials to the surrounding groundwater
    (A) Pesticides
    (B) Nutrients
    (C) Solvents
    (D) Hydrocarbons
    (E) Waste oils

10. L50. Don't forget to adjust your dissolved oxygen meter for this important correction.
    (A) Membrane age
    (B) Barometric pressure
    (C) pH
    (D) Temperature

11. 96M. A pump delivers 240,000 gallons per day at a static head of 275 feet. Calculate the
    pressure equivalent to this head, expressed in pounds per square inch.
    (A) 275 psi
    (B) 635 psi
    (C) 550 psi
    (D) 119 psi

12. R36. Complete the following statement (select all that apply) "A system owner or operator
    must notify the public of an MCL violation…"
    (A) By radio on a commonly listened to station in the area within 8 hours of the violation
    (B) By mail or hand delivery within 45 days of the violation or failure
    (C) By mail every three months after the initial 45 day notification, for as long as the
        violation continues
    (D) By publication in a daily newspaper as soon as possible, not later than 14 days after
        the violation.

13. L56. An amperometric titrator is used to measure:
    (A) Chlorine residual
    (B) COD
    (C) Conductivity
    (D) Alkalinity

14. 41F. A backwash rate of 15 gpm per sq ft of area is approximately equal to a vertical water
    rise per minute of
    (A) 24 in.
    (B) 36 in.
    (C) 12 in.
    (D) 30 in.

15. L75. What is the minimum number of pH standards needed for calibration of a pH meter?
    (A) 2
    (B) 4
    (C) 1
    (D) 3

16. G64. In the water treatment field, mg/L and ppm are considered to be equivalent units.
    (A) False
    (B) True

17. 7MP. A straight ladder, when properly used, should have the base _____ from the supporting wall.
    (A) 1/4 of its length
    (B) 3 ft
    (C) 1/4 of its working length
    (D) 5 ft

18. 39M. Your filters fill your clearwell at a rate of 375 gpm. The clearwell measures 10' wide x
    80' long x 12' deep. If it had 5' of water in it how long would it take to fill completely?
    (A) 111.7 minutes
    (B) 19.1 minutes
    (C) 191 minutes
    (D) 11.1 hours
    (E) 2.9 hours

19. 33M. Your finished water storage tank is 35 feet in diameter and 65 feet high. With no water
    entering it the level dropped 4' in 5 hours. How many gallons of water were used in this period?
    (A) 62,506
    (B) 467,542
    (C) 28,772
    (D) 7,193
    (E) 71,930

20. R37. Endrin, Lindane, Methoxyclor, and Toxaphene are examples of
    (A) Halogens
    (B) Inorganic chemicals
    (C) Organic chemicals
    (D) Metal Salts

21. 61M. If chlorine costs $0.21/lb, what is the daily cost to chlorinate a 5 MGD flow rate at a chlorine dosage of 2.6 mg/l?
    (A) $18.95
    (B) $31.22
    (C) $21.34
    (D) $22.77

22. 96MP. Which of the following provides safety information for potentially hazardous or toxic materials?
    (A) CERCLA
    (B) OSHA
    (C) MSDS
    (D) CFR

23. G43. Control is:
    (A) Concentrating on the present
    (B) Looking forward
    (C) Not connected to other managerial functions
    (D) Looking backward

24. G79. A caustic chemical pump has a pH controller for feed control. The controller needs to maintain a pH of 6.9. As the pH of the finished water decreases, the speed of the pump decreases.
    (A) False
    (B) True

25. 30MP. The rate at which heat is produced is the _____ that the load dissipates.
    (A) Capacitance
    (B) Power
    (C) Resistance
    (D) Work

26. 92M. What is the flow rate (gpm) from a pump with a discharge diameter of 6" and a velocity of 5 ft/sec?
    (A) 198 gpm
    (B) 44 gpm
    (C) 440 gpm
    (D) 338.5 gpm

27. L26. This type of quality control sample is used to determine if contaminants are present.

    _____

28. 104MP. Pulmonary capacity tests are required before operators can be cleared for using respiratory equipment. These tests should be performed at a minimum of once every
    (A) 5 years
    (B) 3 years
    (C) 1 year
    (D) 6 months

29. G27. Which of the following is not an example of a flow measuring device?
    (A) Weirs
    (B) Parshall flume
    (C) Venturi
    (D) Magnetic meter
    (E) Manometer

30. G24. The pressure exerted by a column of water one inch square when at rest, is the _____ pressure. It is usually measured in psi.
    (A) Theoretical
    (B) Practical
    (C) Static
    (D) Dynamic

31. 101MP. In confined space entry, LFL stands for
    (A) Lower flammability limit
    (B) Lifeline/flotation locations
    (C) Low floor level
    (D) Lighting factor limitations

32. 50M. Given the following data, calculate the average velocity in the channel. 2.5 ft wide
    channel, flow depth is 1.4 ft, flow rate is 7.2 MGD
    (A) 32.2 ft/sec
    (B) 1.2 ft.sec
    (C) 3.2 ft/sec
    (D) 11.2 ft/sec

33. 32C. When operating a surface water treatment plant, which of the following laboratory tests
    is of most significance for establishing chemical dosages for coagulating water?:
    (A) Sulfates
    (B) Calcium and magnesium
    (C) Total hardness
    (D) Chlorides
    (E) pH and alkalinity

34. 82M. How many pounds of copper sulfate will be needed to dose a reservoir with 0.6 mg/L
    copper? The reservoir volume is 30 million gallons. The copper sulfate is 25 percent
    copper. Select the closest answer.
    (A) 725 pounds
    (B) 335 pounds
    (C) 500 pounds
    (D) 400 pounds
    (E) 600 pounds

35. 45M. A sand filter with dimensions of 12 feet by 15 feet receives 0.75 mgd. What is the
    hydraulic loading rate in gpm/sft?
    (A) 29.0 gpm/sft
    (B) 4167 gpm/sft
    (C) 2.9 gpm/sft
    (D) 69.4 gpm/sft

36. G60. The formation of layers of different temperature in a body of water is called what?
    (A) Thermal justification
    (B) Limnoptic stratification
    (C) Thermal stratification
    (D) Limnoptic layering

37. G53. 1 acre = _____ square feet.
    (A) 34,650
    (B) 62,500
    (C) 5,280
    (D) 43,560

38. D6. The _____ mean is the mathematical technique used to determine the average of
    several fecal coliform values.
    (A) Geometric
    (B) Fecal
    (C) Arithmatic
    (D) Bioequivalent

39. G83. The slope of a water line is equal to the length of pipe divided by the vertical
    elevation difference.
    (A) False
    (B) True

40. L57. The fecal coliform membrane filter test is incubated at ___ degrees C and produces blue
    or blue-green colonies.
    (A) 35.0 oC
    (B) 98.6 oC
    (C) 44.5 oC
    (D) 37.0 oC

41. L25. This term refers to a false positive caused by dirty glassware or sampling equipment.

    _____

42. R34. Radionuclides include which of the following (select all that apply):
     (A) Alpha and Beta
     (B) Lepton and Photon
     (C) Gamma and Nano
     (D) Gamma

43. L64. Some characteristics of water, such as pH and dissolved oxygen, change so quickly that they need to be measured immediately.
     (A) True
     (B) False

44. 67MP. Under what conditions may an operator refuse to work with a hazardous substance?
     (A) When the scheduled work time interferes with lunch or breaks
     (B) When the operator is unfamiliar with the substance
     (C) When the operator believes management is using the substance as a punishment
     (D) When the operator's employer has failed to provide or attempt to provide an MSDS sheet

45. 12M. The pressure gauge on the bottom of a water holding tank reads 15 psi. The tank is 15 ft in diameter and 40 ft high. How many feet of water are in the tank?
     (A) 38.9 ft
     (B) 25.0 ft
     (C) 11.8 ft
     (D) 34.6 ft

46. 78MP. If water is added to concentrated acid instead of acid into water,
     (A) Temperature decreases and the mixture tends to form ice
     (B) There is no difference
     (C) Water will sink to the bottom immediately
     (D) Heat is generated and the mixture tends to splash acid
     (E) Dilution is faster

47. D38. As water temperatures decrease, the disinfecting action of chlorine
     (A) Decreases
     (B) Increases
     (C) Remains the same

48. 48M. The optimum hydraulic loading rate for a new type of filter is 30 gpm/sft. If the flow going to the filter is 1.85 mgd, what should the dimensions of the filter be? Round to the nearest whole foot.
     (A) 32 sft
     (B) 52 sft
     (C) 43 sft
     (D) 60 sft

49. L60. The pH is a measure of the concentration of _____ ____ in a solution.
     (A) Base equivalents
     (B) Acid equivalents
     (C) Hydrozide ions
     (D) Hydrogen ions

50. 49M. A 42" diameter pipe is flowing at a rate of 6.5 ft/sec. What is the flow rate in cu ft/sec?
     (A) 17.86
     (B) 521.25
     (C) 62.53
     (D) 35.71

51. G49. A ____ sample is a discrete sample that is collected manually.
     (A) Grab
     (B) Flow proportional
     (C) Composite
     (D) Temporal

52. 33F. Some idea of the amount of filter media growth can be indicated by:
     (A) Periodic sieve analysis of the media
     (B) Periodic measurements of the distance from the top of the clean filter to the trough weir
     (C) Periodic determinations of the percent solubility of the media in hydrochloric acid
     (D) all of the above

53. 20W. Gravel tube openings should be elevated above ground level and kept tightly sealed for this reason.
    (A) To ensure that the plant operator can see the gravel depth from a distance.
    (B) To prevent accidental burial of the tube.
    (C) To keep ground pigeons from nesting inside the pipe.
    (D) To prevent well contamination in the even of a flood.

54. 41M. Find the wier loading rate in gpd/ft for a circular tank. The tank is 40 feet in diameter and the influent flow rate is 4 mgd.
    (A) 31847 gpd/ft
    (B) 7960 gpd/ft
    (C) 15794 gpd/ft
    (D) 3185 gpd/ft

55. G34. A high molecular weight substance that is formed by either a natural or synthetic process. Can have either positive or negative charge.
    (A) Enzyme
    (B) Deoxyribonucleic acid
    (C) Carbohydrate
    (D) Polymer
    (E) Protein

56. 78M. After calibrating a chemical feed pump in your plant you have determined that its maximum feed rate is 178 mL/min. If this pump ran continuously at this rate how many gallons would it pump in 1 full day ?
    (A) 256 Gal
    (B) 67.7 gallons
    (C) 17.8 gallons
    (D) 10.7 gallons
    (E) 25.6 gallons

57. 11M. A potable water flowmeter reads 76 gal/min. What is the total flow, in gal/d?
    (A) 1824 gal/d
    (B) 633.8 gal/d
    (C) 14,085 gal/d
    (D) 109,440 gal/d

58. D3. _____ = flow, mgd x chlorine dosage, mg/L x 8.34 lb/gal.

    _____

59. L6. _____ of _____ is a legal term for an unbroken sequence of possession from sample collection through analysis.

    _____

60. 34MP. A pump's seal water pressure should be set at
    (A) 15 to 20 psi more than the pump operating discharge pressure
    (B) 5 to 10 psi more than the pump operating discharge pressure
    (C) 1 to 2 psi more than the pump operating discharge pressure
    (D) At the same level as the pump operating discharge pressure
    (E) 2 to 3 psi below the pump operating discharge pressure

61. 81M. An iron removal plant treats water with an average iron concentration of 3 ppm. If the process removes 90% of the iron and the daily pumpage is 1.5 million gallons, how many pounds of iron are removed per week? Assume 7 day operation.
    (A) 263 pounds per week
    (B) 3.75 pounds per week
    (C) 27 pounds per week
    (D) 236 pounds per week

62. L62. The amperometric titration method is used to measure residual chlorine.
    (A) True
    (B) False

63. D25. What compound is first formed when chlorine is applied to water?
    (A) Chloramines
    (B) Free chlorine ions
    (C) Hydrochloric acid
    (D) Hypochlorous acid

64. 1F. Coagulation and sedimentation alone cannot remove all of the turbidity and suspended matter in raw water. The final step in the removal of suspended mater in water is?
    (A) Sterilization
    (B) Flocculation
    (C) Filtration
    (D) Chlorination

65. 55MP. Which of the following is a likely benefit of a planned maintenance program?
    (A) Extended equipment "life"
    (B) Extended equipment downtime
    (C) Decreased health and safety violations
    (D) Increased emergency repair efficiency

66. L71. The recommended holding time for a fecal coliform sample prior to analysis is 24 hours or less at 4 deg. C.
    (A) False
    (B) True

67. 24M. The entire surface of a free-standing cylindrical tank with an exposed, flat bottom must be painted. The tank does not have a top cover. The tank is 50 inches in diameter and 8 feet high. What is the total interior and exterior surface area to be painted?
    (A) 118 square feet
    (B) 237 square feet
    (C) 105 square feet
    (D) 254 square feet

68. L45. The following flows are mixed together. What is the new TDS concentration? Flow 1 = 10 MGD @ 50 mg/L TDS   Flow 2 = 5 MGD @ 100 mg/L TDS
    (A) 52 mg/L
    (B) 80 mg/L
    (C) 75 mg/L
    (D) 67 mg/L

69. 2MP. The discharge of a centrifugal pump:
    (A) Increases with the increase of head
    (B) Is independent of the head
    (C) Increases with the head increase only at the start of pumping
    (D) Decreases with the increase of head

70. G61. Chlorine, sodium hypochlorite and ultraviolet are commonly used in what water treatment process?
    (A) Oxidation processes
    (B) Filter backwashing
    (C) Manganese and iron removal
    (D) Disinfection

71. 25M. What is the volume of water (in gallons) in an upright 25 foot diameter cylindrical tank with a water depth of 22 feet?
    (A) 80,737
    (B) 13,750
    (C) 10,794
    (D) 90,022
    (E) 102,850

72. 27C. Sedimentation is a process that _____ suspended matter.:
    (A) Filters
    (B) Settles
    (C) Flocculates
    (D) Coagulates

73. R35. The Public Notification Rule is designed to
    (A) Increase the work load of water treatment plant operators
    (B) Keep the public informed of incidents that may affect drinking water quality
    (C) Increase the number of complaint calls to the water treatment plant
    (D) All of the above

74. 93M. What is the pumping rate in gpm of the following piston pump? Diameter = 10 inches, Stroke length = 6 inches, Strokes/min = 30
    (A) 86.9 gpm
    (B) 45.5 gpm
    (C) 293.6 gpm
    (D) 62.1 gpm

75. R32. When does/did/will the final rule for Radionuclides in Drinking Water take effect?
     (A) There is no such rule
     (B) December 31, 2007
     (C) December 8, 2003
     (D) December 7, 2003

76. 17M. A clear well pump delivers 750 GPM to the main water storage tank, The demand for water from this tank is approximately six million gallons per week. How many hours does the pump need to run each week to meet the demand?
     (A) 13 Hours Per Week
     (B) 133 Hours Per Week
     (C) 168 Hours Per Week
     (D) 56 Hours Per Week
     (E) 80 Hours per Week

77. L74. Coliform bacteria and the procedures used to test for them are divided into the two categories of _____.
     (A) LTB and BGB
     (B) Total and fecal coliforms
     (C) MF and MTF
     (D) M-Endo and M-FC

78. 15M. A water treatment plant used 647 chlorine cylinders during one year of operation. The average withdrawal from each cylinder was 138 lbs. What was the total number of pounds of chlorine used for the year?
     (A) 70872
     (B) 89286
     (C) 69876
     (D) 50370

79. 6M. Your pump ran continuously for 24 hrs and delivered 288,000 gal. The capacity of the pump is _____ gpm. Select the closest answer.
     (A) 100
     (B) 200
     (C) 12000
     (D) 1000

80. 111M. Your plant's maximum capacity is 1.3 MGD. If you produced 67% of this capacity in one day how many gallons would this be ?
     (A) 1,100,201 gallons
     (B) 87,100 gallons
     (C) 19,402 gallons
     (D) 194,020 gallons
     (E) 871,000 gallons

81. 36M. Compute the detention time in hours in a final sedimentation basin given: Diameter = 95' Depth = 11' Flow rate = 7.0 MGD
     (A) 4 hrs 10 min
     (B) 2 hrs 10 min
     (C) 1 hr. 59 min
     (D) 1 hr

82. G66. The total solids in water would be a combination of:
     (A) Fixed solids and dissolved solids
     (B) Dissolved solids and suspended solids
     (C) Dissolved solids and volatile solids
     (D) Fixed solids and settleable solids
     (E) Suspended solids and fixed solids

83. 101M. Through jar testing, you have determined that your best Alum dose is 5 mg/L. Your liquid alum has a specific gravity of 1.31 and its strength is 49.8%. Your plant flow is 700 GPM. How many mL/min will your chemical feed pump need to pump to produce this residual?
     (A) 200 mL/min
     (B) 84.1 mL/min
     (C) 10.1 mL/min
     (D) 42.0 mL/min
     (E) 20.3 mL/min

84. 1W. What percentage of the water used in the United States comes from underground sources?
     (A) 60%
     (B) 45%
     (C) 30%
     (D) 90%

85. 13F. A rate of flow controller is used to?
   (A) Maintain a predetermined flow through the filter
   (B) Measure the amount of water used to wash the filter
   (C) Calculate particulate removal
   (D) Check when the filter is air-bound

86. 3M. How many gallons of water are there in 5 cubic feet?
   (A) 100.0 gallons
   (B) 41.7 gallons
   (C) 37.4 gallons
   (D) 15.0 gallons

87. 7M. A fluid with a specific gravity of 1.05 weighs _____ lb/gal.
   (A) 7.2
   (B) 8.5
   (C) 8.8
   (D) 8.4

88. L52. Alkalinity and hardness are both expressed analytically as this.

   _____

89. 31M. What is the average detention time in a basin given the following: diameter = 80' depth
   = 12.2' flow = 5 MGD
   (A) 1.68 hrs.
   (B) 2.2 hrs.
   (C) 1.74 hrs.
   (D) 2.4 hrs.

90. 18F. A loss-of-head gauge indicates when:
   (A) Sludge should be removed from the sedimentation basin
   (B) The filter should be backwashed
   (C) The elevated tank is full
   (D) The filter should be chlorinated
   (E) The chlorine cylinder is empty

91. 16F. A loss of head gauge is used:
   (A) To measure the head of water on the filter sand
   (B) To control the rewash valve
   (C) To measure the drop in pressure through the filter bed
   (D) To indicate the rate of filtration
   (E) None of these are correct

92. R21. What are the MCL and MCLG for barium?
   (A) 4 mg/L and 4 mg/L
   (B) 2 ppm and 2 ppm
   (C) 2 ppb and 2 ppb
   (D) 1 mg/L and 1 mg/L

93. 13W. Select the best description of the function of a well pump pedestal.
   (A) Supports the weight of the pumping unit.
   (B) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess
       air during well recovery period.
   (C) Permits sampling of pumped water.
   (D) Permits insertion of water level measuring device. Also used to add chlorine or well
       cleaning agents.
   (E) Permits discharge of air in column pipe during start-up and admits air during shutdown.
   (F) Permits operator to see level of gravel and add gravel as necessary.
   (G) Permits measurement of water level by means of air pressure measurements.
   (H) Provides watertight seal between the motor base and the concrete support pedestal.

94. G76. Which of the following flow measuring devices is the most accurate?
   (A) Magnetic meter
   (B) Weir
   (C) Venturi tube
   (D) Parshall flume

95. 19C. Proper flocculation requires:
   (A) Frequent filter backwashing
   (B) Rapid and complete mixing
   (C) Long, gentle mixing
   (D) Low water temperature and high pH values

96. 38F. What is the rated capacity of a rapid-sand filter 20 ft X 17.5 ft X 10 Ft deep when operated at a filter rates of 2gpm/ft2?
        (A) 700 gpm
        (B) 2800 gpm
        (C) 7000 gpm
        (D) 1400 gpm

97. 64MP. A well pump is delivering less than the rated capacity. It does not appear to be breaking suction or rotating incorrectly. What is the next most likely cause?
        (A) Motor overloaded
        (B) Well is pumping sand
        (C) Worn or improperly adjusted impeller
        (D) Pumping against excessively low head

98. R5. Non-transient, non-community water systems are required to comply with the new Arsenic MCL of 10 ug/L.
        (A) True
        (B) False

99. D18. Which of the following would be the safest action to take in the event of a major chlorine container leak?
        (A) Roll the container so that liquid escapes rather than gas.
        (B) Submerge the container in a basin or stream
        (C) Call the fire department
        (D) Notify local police or sheriff

100.37MP. Centrifugal pump parts include a(n)
        (A) Diaphragm
        (B) Impeller
        (C) Piston
        (D) Rotor

101.D29. The destruction of the larger portion of microorganisms with the probability that all pathogens are killed is called
        (A) Disposal
        (B) Disinfection
        (C) Sterilization
        (D) Digestion
        (E) Dilution

102.35W. Wells in aquifers with high mineral contents or high dissolved solids will need to be cleaned
        (A) With the same frequency as those in low mineral aquifers
        (B) More frequently than those in low mineral aquifers
        (C) You have to clean wells???
        (D) Less frequently than those in low mineral aquifers

103.L16. Interferences are substances in a sample that can cause false _____ and false _____

        _____

104.20F. Air binding of a filter can be caused by?
        (A) The reduction of pressure resulting from operating under a negative head
        (B) An increase in the temperature of the water during filtration
        (C) The release of oxygen by algae collected within the filter
        (D) All of the above

105.47MP. Besides throttling the inlet valve, what type of control is used for a centrifugal pump?
        (A) Outlet backpressure
        (B) Pipe length
        (C) Pipe material
        (D) Variable frequency drives

106.86MP. The Hazard Communication Standard (HazCom)
        (A) Affects everyone using chemicals in the workplace
        (B) Requires employers to develop a written HazCom program
        (C) Requires the posting of Material Safety Data Sheets
        (D) Two of these answers are correct
        (E) All of these answers are correct

107.D40. If chlorine costs $0.21/lb, what is the daily cost to chlorinate 5 mgd of water to an initial concentration of 2.6 mg/l?
    (A) $108.42
    (B) $56.80
    (C) $516.29
    (D) $22.77

108.31W. It isn't enough to just add chlorine to a well. For shock treatment to be effective, you must also do this.
    (A) Aggitate the chlorine solution.
    (B) Completely seal all well vents.
    (C) Draw large volumes of water out of the well during treatment.
    (D) Add hot water to speed up the reaction.

109.62MP. A well pump is starting more frequently than it should. Possible causes include:
    (A) Waterlogged tank
    (B) Loose or broken wire
    (C) Defective pressure switch
    (D) Defective motor
    (E) Leaking foot valve

110.G87. What calibrated device developed for measuring flow in an open channel consists of a contracting length, a throat with a sill, and an expanding length?
    (A) Magmeter
    (B) Equalizing tank
    (C) V-notch weir
    (D) Parshall flume

111.G67. Which of the following terms refers to the addition of chemicals to a sample in the field to prevent water quality indicators from changing before final measurements are performed?
    (A) Preservation
    (B) Standardization
    (C) Buffer
    (D) Titration

112.63M. Determine the required chlorinator setting in lb/day given: Steady flow rate of 5.5 MGD, Target chlorine residual = 2.5 mg/l, Average chlorine demand = 2.5 mg/l
    (A) 213 lbs/day
    (B) 251 lbs/day
    (C) 195 lbs/day
    (D) 229 lbs/day

113.97M. Determine the flow capacity of a pump in gpm if the pump lowers the water in a six-foot square clear well by 8 inches in 5 minutes.
    (A) 179.5 gpm
    (B) 35.9 gpm
    (C) 92.4 gpm
    (D) 430 gpm
    (E) 57.6 gpm

114.9W. Select the best description of the function of a well casing vent.
    (A) Permits discharge of air in column pipe during start-up and admits air during shutdown.
    (B) Permits measurement of water level by means of air pressure measurements.
    (C) Provides watertight seal between the motor base and the concrete support pedestal.
    (D) Permits sampling of pumped water.
    (E) Permits insertion of water level measuring device. Also used to add chlorine or well cleaning agents.
    (F) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess air during well recovery period.
    (G) Used to remove first water (usually sandy) pumped at start-up.
    (H) Supports the weight of the pumping unit.

115.36C. What determines the optimum and most cost-effective amount of a coagulant to use?:
    (A) Beyond that dose, it takes a very large increase in the amount of chemical to produce a small increase in turbidity removal
    (B) The treatment plant budget
    (C) Divide the number of gallons of water in the coagulation tank by the nephelometric turbidity unit reading to determine the dosage in mg/L.
    (D) Below that dose the coagulant results in poor settling

116.15C. Clarification of water by sedimentation and filtration removes:
    (A) Dissolved solids
    (B) Suspended solids
    (C) Volatile solids
    (D) All of these are correct

117.43W. Special procedures are needed to clean and disinfect an existing well after it has been
    taken out of service for repairs for this reason.
    (A) Airborne bacteria may be present in the well, however, a thorough air purge will
        remove them.
    (B) Disturbed sediments may contain high numbers of bacteria.
    (C) Dislodged bacteria may be deposited on the inside of the well casing above the water level.
    (D) Working on the well may have introduced bacteria from the operator's skin.

118.38M. What is the detention time in a reservoir if the influent flow rate is 0.785 MGD, the
    reservoir depth is 22 feet, and the reservoir covers 17 acres?
    (A) 56 days
    (B) 97 days
    (C) 180 days
    (D) 420 days
    (E) 155 days

119.9MP. A possible cause of electric motor failure is?
    (A) Dirt
    (B) Moisture
    (C) Friction
    (D) All of these

120.L34. The blank plate for a fecal coliform test should have this many colonies growing on it.

    _____

121.G99. Every filter plant operator's goal for effective removal of cryptosporidium and giardia
    should be an effluent turbidity never greater than:
    (A) 0.20 NTU
    (B) 0.50 NTU
    (C) 0.40 NTU
    (D) 0.30 NTU
    (E) 0.10 NTU

122.G59. What does TDS stand for?
    (A) Temporarily dissolved solids
    (B) Total disaggregated solids
    (C) Total dissolved salts
    (D) Total dissolved solids

123.G31. The most critical criterion for determining when a mixed media filter should be
    backwashed is:
    (A) Visual inspection of the filter surface
    (B) Filter effluent quality
    (C) Flow rate
    (D) Head loss

124.36W. If a check valve failed on a well pump station, the most likely outcome would be
    (A) Water would flow out of the aquifer, through the well pump, and into the distribution system
    (B) The well pump would automatically shut down
    (C) Water would flow back through the well pump and into the aquifer, potentially
        contaminating it
    (D) Water, unable to move into the distribution system, would back up into the well pump
        until the pressure relief valve was tripped

125.57M. There are two raw water lines entering a treatment plant. One line carries a flow rate
    of 500 gal/min with a TDS concentration of 1500 mg/l, and the other has a flow rate of 6 MGD
    with a 250 mg/l TDS. What is the actual combined TDS concentration entering the plant? Round
    off answer to nearest full unit.
    (A) 1200 mg/L
    (B) 420 mg/l
    (C) 384 mg/l
    (D) 700 mg/l

126.79M. Your chemical supplier charges you $1.28 / gallon of caustic soda. You have determined you will need approximately 60.1 (55 Gal) drums per year, what would be your annual budget cost for this item ?
        (A) $6,819.71
        (B) $14,932.00
        (C) $8,833.29
        (D) $3,305.50
        (E) $4,231.04

127.10F. The function of the filter under-drains is best described as:
        (A) Providing access to the media
        (B) Aeration of the media to encourage bacteria growth
        (C) Collection of treated water and distribution of backwash
        (D) Draining off the excess oxidant

128.22MP. If the pump bearings on horizontal pumps are over lubricated, the most important effect is that the extra lubricant:
        (A) May cause overheating and possible failure of the bearings
        (B) Will result in smoother and more efficient operation
        (C) Will be wasted
        (D) Will not make any difference in the operation of the pump

129.60MP. A well pump will not start. Upon inspection, the operator discovers that the in-line valve has been accidentally shut off. The appropriate corrective action is
        (A) Adjust the PRV and then restart the pump.
        (B) Take an early smoke break and wait for the second shift guy to fix the problem.
        (C) Open the closed valve and then restart the pump.
        (D) Check the discharge line pressure.

130.D13. The fusible plug on a chlorine cylinder melts at about _____ degrees.
        (A) 135 - 158
        (B) 158 - 165
        (C) 165 - 172

131.G32. A process in which a tank or reactor is filled, the water treated, then the tank is emptied, and the process repeated is called_____.
        (A) Industrial process
        (B) Batch process
        (C) Intermittent process
        (D) Continuous process

132.L2. When conducting the fecal coliform membrane test, count all the colonies that are _____ in color.
        (A) Blue
        (B) Yellow
        (C) Red
        (D) Orange

133.D7. Total and fecal coliform are pathogenic.
        (A) False
        (B) True

134.5W. This condition results when more water is removed from an aquifer than is replaced through rain and snowmelt.
        (A) Air binding
        (B) Overdraft
        (C) Dry welling
        (D) Rising water table

135.12C. In order for a chemical to function satisfactorily as a coagulant, it must:
        (A) Cause floc formations
        (B) Destroy bacteria
        (C) React with the lime
        (D) Remove tastes and odors

136.R2. Community water systems that detect between 5 and 10 ug/L of Arsenic in their water supply after January 23, 2006 must include what information in their consumer confidence report (CCR)?
        (A) No information is required since it is below the MCL
        (B) Notice of impending violation
        (C) Health effects information.
        (D) An educational statement.

137.L5. Suspended solids, also referred to as filterable residue, represent the weight of solids remaining on a glass fiber filter following filtration and drying at ___ degrees C.
    (A) 180
    (B) 103
    (C) 44.5
    (D) 35.0

138.90M. A centrifugal pump is pumping 200 gpm against a 40 ft total pumping head. The output power of the pump is approximately _____ hp.
    (A) 121
    (B) 15
    (C) 2
    (D) 0.5

139.88M. A flow of 180 gpm will be treated with a 2.5 percent solution of sodium fluoride. The raw water contains 0.3 mg/L of fluoride ion and the desired fluoride ion concentration is 1.4 mg/L. Calculate the sodium fluoride feed rate in gallons per day. Assume the sodium floride contains 43.4 percent fluoride.
    (A) 26.3 gpd
    (B) 3.3 gpd
    (C) 2.4 gpd
    (D) 14 gpd
    (E) 23 gpd

140.G45. The best approach to complaints involving the operation of a water plant is to:
    (A) Never admit there is a problem or cause for the complaint
    (B) Publicize the problem as much as possible
    (C) Explain the problem and proposed solution and offer to conduct a tour of the plant for those complaining
    (D) Keep all persons except for operating personnel out

141.G70. Venturi flowmeters can measure flow when partially full of liquid.
    (A) False
    (B) True

142.R33. The Final Radionuclide Rule applies only to CWS and not NTNWCS at this time
    (A) True
    (B) False

143.51W. Check all of the potential sources for groundwater contamination
    (A) Septic tanks
    (B) Fertilizers and pesticides
    (C) Sprinkler systems
    (D) Truck stops and parking lots
    (E) Animal wastes

144.20C. The lower the turbidity,:
    (A) The greater the zeta potential
    (B) The more difficult it is to form a proper floc
    (C) The lower the temperature of the water
    (D) The higher the dose of coagulant needed

145.30C. What conditions call for the use of plate or tube settlers?:
    (A) Algal bloom
    (B) Extremely turbid water
    (C) Zebra mussel infestation
    (D) High iron and manganese

146.G108. In water treatment, potassium permanganate is used primarily as:
    (A) A tracing Agent
    (B) An oxidant
    (C) A coagulant
    (D) A disinfectant
    (E) A corrosion inhibitor

147.L24. The statistical calculation done to determine the spread of a set of measurements is called the _____.
    (A) Relative Pervasive Difference
    (B) Standard Deviation
    (C) Percent Deviation
    (D) Standard Error

148.D28. If you need a chlorine residual of 1 mg/l, how many pounds of chlorine must be applied
    each day if the flow is 2.5 mgd and the chlorine demand is 15 mg/l?
        (A) 312 lb/d
        (B) 419 lb/d
        (C) 516 lb/d
        (D) 291 lb/d
        (E) 334 lb/d

149.R25. A system will be required to replace service lines made of lead (Pb) after what series
    of events - check all that apply.
        (A) System fails to meet the lead action level in tap samples after installing corrosion control.
        (B) Systems that fail to monitor for lead on a monthly basis.
        (C) Systems that have budgeted for service line replacement.
        (D) System fails to meet the lead action level in tap samples after source water treatment.

150.41W. A new well has been disinfected according to the standard operating procedure, but a
    fecal coliform sample taken after disinfection still shows colony growth. The operator should
        (A) Place the well into service, but maintain twice the normal residual chlorine
            concentration for a few days.
        (B) Place the well into service anyway. It will be fine after a couple of hours.
        (C) Disinfect the well again without skipping any steps.
        (D) Abandon the well.   If it isn't clean now, it never will be.

151.L28. Total Dissolved Solids are dried at this temperature.
        (A) 550oC
        (B) 105oC
        (C) 103oC
        (D) 180oC

152.D26. The amount of chlorine used per day from a 1 ton cylinder is normally determined by
        (A) Weighings
        (B) Rotometers
        (C) Pressure gauges
        (D) Chlorine residuals
        (E) Ammonia equivalents

153.G47. When an employee seems to have made an error, a supervisor should first;
        (A) Obtain all the relevant facts.
        (B) Keep a written record of events.
        (C) Have the employee admit the error.
        (D) Have a pleasant discussion with the employee.

154.G39. Public relations are important because we:
        (A) Don't want to be late for lunch
        (B) Must deal with the public
        (C) Want to keep our jobs
        (D) Want to finish our work in a hurry
        (E) Hate listening to whiners

155.91M. A raw water pump with a 6" bore and a 3" stroke pumps 60 cycles/minute. What is the
    pumping rate in gpm?
        (A) 26.75 gpm
        (B) 22.5 gpm
        (C) 18 gpm
        (D) 14.3 gpm

156.G82. Chlorine is primarily used to
        (A) Disinfect
        (B) Raise pH
        (C) Stabilize organics
        (D) Prevent corrosion

157.105MP. According to Article 250 of the US National Electric Code (NEC), what color should
    ground wires be?
        (A) Green
        (B) Red
        (C) Blue
        (D) Yellow

158.D14. Exhaust air from a chlorine tank room should be taken from where?
    (A) Any location
    (B) At the ceiling
    (C) Floor level
    (D) Near the entrance

159.14C. The treatment of water with chemicals to cause the non-settleable particles to form larger settleable particles is called:
    (A) Coagulation-flocculation
    (B) Recarbonization
    (C) Aeration
    (D) Ionization

160.21F. Mud balls are?
    (A) Small balls of mud found in the distribution system
    (B) Not significant
    (C) An aggregate of solids accumulated in sand filter beds
    (D) Bacterial residues

161.G42. Generally, as an individual progresses upward in management, reliance on personal technical skill:
    (A) Decreases
    (B) Increases
    (C) Becomes more complex
    (D) Remains the same

162.G33. A _____ sample consists of a collection of individual samples collected at regular intervals throughout the day
    (A) Grab
    (B) Composite
    (C) Weighted average
    (D) Final effluent

163.L72. What piece of laboratory glassware is used mainly to mix chemicals and measure approximate volumes?
    (A) Buret
    (B) Beaker
    (C) Pipet
    (D) Graduated cylinder

164.G9. Required chemical coagulation doses are commonly determined by:
    (A) Jar tests
    (B) Measurements of zeta potential
    (C) Oxidation-reduction investigations
    (D) Stoichiometric calculations

165.D36. Which of the following methods is not used to determine chlorine residual?
    (A) Photometric
    (B) Titrimetric
    (C) Iodometric
    (D) Amperometric

166.31C. A test that is commonly performed to monitor the treatment process is :
    (A) pH
    (B) Alkalinity
    (C) Turbidity
    (D) All of the above

167.G62. Floats, ultrasonic devices, and bubblers are all examples of what type of sensing equipment?
    (A) Level
    (B) Flow
    (C) pH
    (D) Velocity

168.88MP. If you arrive at an accident scene, which step should you take first?
    (A) Check the scene for safety
    (B) Care for the victim
    (C) Interview witnesses to determine what is wrong
    (D) Call 911 or the local emergency number

169.20MP. In electrical circuits a(n) _____ is used to reduce voltage where needed.
   (A) Ammeter
   (B) Transformer
   (C) Thermal overload
   (D) Voltmeter

170.D39. How many pounds of chlorine will be used in one day if the flow is 700,000 gal/d and a uniform dose of 1.2 mg/l is applied?
   (A) 70.1 lb
   (B) 698.3 lb
   (C) 7.0 lb
   (D) 7005 lb

171.G98. Chlorine gas is:
   (A) Lighter than air
   (B) The same as air
   (C) Completely harmless
   (D) Heavier than air

172.22C. The effluent weir of a sedimentation basin should be level in order to prevent:
   (A) Uneven flows and short circuiting
   (B) They need not be kept level
   (C) Clogging of the "V notch"
   (D) Corrosion of the weir material

173.49MP. The formation and collapse of gas pockets or bubbles on the blade of a centrifugal pump's impeller is known as what?
   (A) Cavitation
   (B) Compression
   (C) Entrainment
   (D) Combustion

174.16W. Select the best description of the function of a well Air-release vacuum breaker valve.
   (A) Permits operator to see level of gravel and add gravel as necessary.
   (B) Permits insertion of water level measuring device. Also used to add chlorine or well cleaning agents.
   (C) Permits discharge of air in column pipe during start-up and admits air during shutdown.
   (D) Supports the weight of the pumping unit.
   (E) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess air during well recovery period.
   (F) Provides watertight seal between the motor base and the concrete support pedestal.
   (G) Permits measurement of water level by means of air pressure measurements.
   (H) Permits sampling of pumped water.

175.48MP. What type of pump is typically used to feed ferric chloride for coagulation purposes?
   (A) Metering pumps
   (B) Rotary lobe pumps
   (C) Progressing cavity pumps
   (D) Gear pumps

176.D43. Which pair of parameters is most typically used to adjust chlorine feed rates?
   (A) Sulfur dioxide supply and flow rate
   (B) Chlorine residual and water flow
   (C) Chlorine supply and temperature
   (D) Sulfur dioxide supply and chlorine supply

177.G29. The main action of a mixed media filter is:
   (A) Disinfecting
   (B) Coagulating
   (C) Straining
   (D) None of the above

178.12MP. Friction in a pipeline causes:
   (A) Overheating
   (B) Corrosion
   (C) Loss of pressure
   (D) Aeration

179.L1. In the membrane filter method, the number of coliforms is estimated by the:
   (A) Sum of positive and negative tubes
   (B) Number of colonies grown
   (C) Number of negative tubes
   (D) Number of positive tubes

180.R7. The Safe Drinking Water Act (SDWA) was passed by Congress in
          (A) 1974
          (B) 1918
          (C) 1965
          (D) 1982

181.26M. You are going to add 6" of coal to one of the filters in your plant. The filter
     measures 10' x 12'. Each bag of coal contains 3 cubic feet. How many bags will you need to order?
          (A) 60 bags
          (B) 32 bags
          (C) 20 bags
          (D) 15 bags
          (E) 10 bags

182.D42. At concentrations less than _____, chlorine gas is not detectable by the human sense of smell.
          (A) 10 ppm
          (B) 1 ppm
          (C) 4 ppm
          (D) 2 ppm

183.59MP. A well pump will not start. The circuit breaker is not tripped and no fuses are
     burned out. The motor is hot to the touch. The operator should
          (A) Replace a leaky foot valve.
          (B) Check and replace the motor air filter.
          (C) Check the motor to see if the overload relay has tripped.
          (D) Replace a defective pressure switch.

184.8MP. The main function of a lubricant is to keep moving materials separate from each other.
          (A) False
          (B) True

185.G28. Convert 18 degrees Celsius to Fahrenheit
          (A) 50.6
          (B) 34.2
          (C) 68.5
          (D) 64.0

186.G91. Cross connections should never be allowed in water distribution systems because they
     might result in contamination.
          (A) True
          (B) False

187.4M. If water weighs 8.34 lbs/gal, how much will 7.5 gal weigh?
          (A) 75.5 lbs.
          (B) 62.6 lbs
          (C) 50.8 lbs
          (D) 77.3 lbs

188.48W. Unlike surface waters, well waters do not need to be disinfected prior to entering the
     distribution system
          (A) True
          (B) False

189.R8. What does MCL stand for?
          (A) Minimum Contaminant Level
          (B) Minimum Containment Level
          (C) Maximum Contaminant Level
          (D) Maximum Contact Limit

190.5MP. If packing is not maintained properly,
          (A) The impeller will corrode
          (B) There will be a loss of suction from air being allowed to enter the pipe.
          (C) The shaft or shaft sleeve will be damaged
          (D) Cavitation damage will result

191.40MP. A device that causes the water in a vertical riser pipe to rise to an outlet using
     compressed air is called an
          (A) Draft tube
          (B) Air lift pump
          (C) Capillary pump
          (D) Suction pump

192.D35. Chlorine applied minus _____ equals chlorine residual
    (A) Chlorine dose
    (B) Combined chlorine
    (C) Total chlorine
    (D) Chlorine demand
    (E) Free chlorine

193.28C. Sludge accumulations in settling basins over a period of time usually:
    (A) Result in taste and odor problems
    (B) Result in the growth of pathogenic organisms
    (C) Add hardness to the water
    (D) Increase the algae growth

194.46MP. If your facility cannot tolerate power loss even for short periods, then you need an emergency generator that can _____.
    (A) Switch on after a specific time between power losses
    (B) Automatically switch over when power goes down
    (C) Power the entire facility
    (D) Manually switch over

195.10MP. A water seal on a pump serves a dual purpose. It acts as a lubricant and it also:
    (A) Keeps the pump primed
    (B) Keeps gritty material from entering the packing box
    (C) Is a reserve water supply
    (D) Acts as a coolant to keep the bearing from overheating

196.42W. What concentration of residual chlorine should be maintained for 24 hours in a newly constructed well?
    (A) 50 ug/L
    (B) 25 ug/L
    (C) 25 mg/L
    (D) 50 mg/L

197.5F. Which of the following unit processes would diatoms most likely affect?
    (A) Filtration
    (B) Flocculation
    (C) Sedimentation
    (D) Coagulation

198.L11. What is the common name for commercial sodium carbonate?
    (A) Slaked lime
    (B) Lime
    (C) Baking soda
    (D) Soda ash

199.D15. Coliform bacteria are:
    (A) Coagulant aids
    (B) Indicators
    (C) Algae
    (D) Sequestering agents

200.40M. Calculate the weir loading for a sedimentation tank that has an outlet weir 480 ft long and a flow of 5MGD.
    (A) 9,220 gpd/ft
    (B) 9,600 gpd/ft
    (C) 9,920 gpd/ft
    (D) 10,420 gpd/ft

201.L38. Fecal coliforms are incubated in a water bath at this temperature for 24 hours.
    (A) 103 oC
    (B) 44.5 oC
    (C) 35.0 oC
    (D) 37.5 oC

202.R11. SDWA stands for
    (A) Safe Disposal of Wastewater Act
    (B) Safe Drinking Water Act
    (C) Sanitary Drain Waste Action
    (D) Soluble Dissolved Waste Atoms

203.17MP. Why are check valves sometimes used on the suction side of centrifugal pumps?
      (A) To prevent water in the suction line from flowing back into the wetwell
      (B) To equalize the pressure on both sides of the impeller
      (C) To prevent water in the discharge line from flowing back into the wetwell
      (D) To regulate the rate of flow through the discharge pipe.

204.74MP. "Combustible" liquids have a flash point _____ 100 degrees F
      (A) Below
      (B) Above
      (C) Approximately equal to
      (D) What's a flash point?

205.D5. Chlorine gas is _____ times heavier than air.
      (A) 2.0
      (B) 1.5
      (C) 3.5
      (D) 2.5

206.43MP. What is an air-gap device used for?
      (A) To prime pumps
      (B) To seal valves
      (C) Insulation
      (D) Backflow prevention

207.30W. When performing chlorine treatment of wells, it is important not to mix sodium and calcium hypochlorite together for this reason.
      (A) Extreme heat or an explosion could occur.
      (B) Excessive quantities of chloramines would be formed.
      (C) Toxic gases may be produced.
      (D) Precipitation of the calcium would occur, rending the mixture ineffective.

208.106M. A water treatment plant treats 36,520,000 gallons during the month of July. The total water measured in various storage tanks is 28,710,000 gallons. What percentage of treated water is unaccounted for?
      (A) 78.6%
      (B) 63.0%
      (C) 27.2%
      (D) 21.4%

209.21M. A cylindrical tank is 10 ft in diameter and 20 ft in height. What is the approximate capacity in liters?
      (A) 31,030 liters
      (B) 44,450 liters
      (C) 4,445 liters
      (D) 5,942 liters

210.D16. Acids should never be added to chlorine solutions because they
      (A) Corrode the solution tank
      (B) Result in the formation of chlorine precipitate
      (C) Decrease the disinfecting properties of chlorine
      (D) Cause chlorine gas to be released

211.81MP. Forklift accidents are particularly dangerous because of
      (A) Toxic emissions generated by most forklifts
      (B) Forklift speed
      (C) None of these answers are correct
      (D) The tremendous weight of the forklift

212.39F. The surface of a sand bed filter measures 20 ft by 30 ft. If the flow through the filter is 1800 gpm, what is the surface lading rate in gallons per minute per square foot?
      (A) 0.5
      (B) 2
      (C) 1
      (D) 3

213.D10. Proper disinfection kills all organisms.
      (A) False
      (B) True

214.2F. What is the primary purpose of filtration?
    (A) To reduce the velocity of water in basins
    (B) To remove fine suspended matter from the water
    (C) To bring suspended particles together to form larger, more settleable clumps
    (D) to settle large particles out of the water

215.40W. Put the following steps for disinfecting a new well prior to placing it into service.
    (A) Turn the pump on and off several times to mix the well.
    (B) Test for chlorine residual.
    (C) Re-mix well several times at one-hour intervals.
    (D) Collect a bacteriological sample.
    (E) Wait 24 hours.
    (F) Pump well water to waste until chlorine smell is gone.
    (G) Add enough chlorine to produce a concentration of 50 mg/L in the well casing.

    Arrange in proper sequence: _____

216.103MP. Personnel should not work alone on energized equipment, for example, a magnetic
    starter, that operates at or above
    (A) 240 V
    (B) 480 V
    (C) 60 V
    (D) 120 V

217.L12. Both total and fecal coliforms are reported in units per 100 mL if the membrane filter
    technique is used, or as the ____ ____ ____ per 100 mL if the multiple tube method is used.

    _____

218.G44. There are generally more limitations on authority the farther one:
    (A) Ascends
    (B) Descends
    (C) Moves horizontally
    (D) Remains in the same position

219.46W. Two potential problems that can affect wells are
    (A) Rising groundwater levels
    (B) Low mineral content
    (C) Excessive use or overdraft
    (D) Groundwater pollution

220.59M. Liquid polymer is delivered as an 8 percent solution. How many gallons of liquid
    polymer should be mixed in a tank to produce 150 gallons of 0.6 percent polymer solution?
    (A) 2.5 gallons
    (B) 11.3 gallons
    (C) 22.5 gallons
    (D) 7.5 gallons
    (E) 17.5 gallons

221.R30. Why are nitrites/nitrates considered a health hazard in drinking water?
    (A) Nitrate converts to nitrites in the body and is stored in the brain.
    (B) Nitrate converts to nitrite in the body and interferes with the oxygen-carrying
        capacity of blood.
    (C) Nitrate converts to nitrite in the body and fertilizes the intestinal tract.
    (D) Nitrate and nitrite are both stored in the body and form pouches under the skin.

222.105M. Of the $900 allotted for maintenance in the monthly budget, 15 percent was spent on
    pump repair. How much money was spent?
    (A) $765
    (B) $13.5
    (C) $135
    (D) $450

223.100M. How many kilowatt-hours per day are required by a pump with a motor horsepower of 50
    horsepower when the pump operates 24 hours a day?
    (A) 716 kW-hr/day
    (B) 1,075 kW-hr/day
    (C) 1,287 kW-hr/day
    (D) 960 kW-hr/day
    (E) 894 kW-hr/day

224.G10. The weight of a chemical compound is 1/8 of the total weight of a chemical solution.
The percent by weight, of the chemical in solution is:
    (A) 12.5
    (B) 8.3
    (C) 6.4
    (D) 10.5

225.L43. This is the titrant used for the Hardness analysis.
    (A) 0.125 N Hydrochloric acid
    (B) 0.03 N Sulfuric acid
    (C) EDTA - A Chelating Agent
    (D) Sodium hydroxide

226.108M. Express 7,960 in scientific notation.
    (A) None of these is correct.
    (B) $7.96 * 10^3$
    (C) $7.96 * 10^{-3}$
    (D) $7.96*10^5$

227.R9. What does MCLG stand for?
    (A) Minimum Contaminant Level Goal
    (B) Maximum Contact Limit General
    (C) Maximum Contaminant Level Goal
    (D) Minimum Containment Level General

228.D33. Calculate the chlorine demand given: flow rate = 120 mgd; chlorine feed rate = 8000
lb/d; chlorine residual = 1.0 mg/l after contact time.
    (A) 6 mg/L
    (B) 7 mg/L
    (C) 5 mg/L
    (D) 8 mg/L

229.34W. How much water is produced by a given well depends on these three factors. If the well
stops producing the same amount of water as it used to, it is probably because of a change in
one of these three factors.
    (A) The aquifer
    (B) The well
    (C) The pump
    (D) The operator

230.37W. One consequence of pumping sand into the distribution system is
    (A) Clogging of fire hydrant orifices
    (B) Eventual collapse of the well due to wall erosion
    (C) Decreased water volume in the distribution system
    (D) Increased wear on lift station pumps and impellers

231.G80. The reverse-acting actuator on a control valve is pneumatic. The valve is 50% open. As
you decrease the input signal to the valve, it opens 60%. The valve is functioning normally.
    (A) False
    (B) True

232.69MP. The Threshold Limit Value (TLV) of a substance may be expressed as a
    (A) Time Weighted Average (TWA)
    (B) Lower Exposure Limit (LEL)
    (C) Ceiling (C) exposure limit
    (D) Short-Term Exposure Limit (SEL)
    (E) As TWA, SEL, or Ceiling
    (F) Permissible Exposure Limit (PEL)
    (G) As either Ceiling or TWA

233.L69. Jar tests may be used to determine the optimum dosage of
    (A) Polymer
    (B) Oil and grease
    (C) Volatile acids
    (D) Biochemical oxygen demand

234.85M. A water treatment plant used 24 pounds of cationic polymer to treat 1.4 million gallons
of water during a 24-hour period. What was the polymer dosage in mg/L?
    (A) 18 mg/L
    (B) 36 mg/L
    (C) 2 mg/L
    (D) 5 mg/L
    (E) 48 mg/L

235.G18. The saturation level for oxygen in water _____ when temperature increases.
    (A) Decreases
    (B) Increases
    (C) Stays about the same

236.31MP. _____ is the relationship in time between two waveforms of the same frequency.

    _____

237.104M. A wet well level transmitter says 56% on a scale of 0% to 100%. The full depth of the
    wet well is 35 ft. How many feet of water are in the wet well?
    (A) 20.3 ft
    (B) 17.8 ft
    (C) 15.2 ft
    (D) 19.6 ft

238.D9. One volume of liquid chlorine will yield about ____ volumes of chlorine gas.
    (A) 500
    (B) 360
    (C) 450
    (D) 800

239.D12. Coliform bacteria are:
    (A) Less resistant to chlorination than pathogenic bacteria
    (B) A group of pathogens causing cholera
    (C) More resistant to chlorination than pathogenic bacteria
    (D) A group of pathogens causing hepatitis

240.L44. This is the technical term for the process of converting one unit to another is called.

    _____

241.G30. A wet well probe is usually used for _____ determination(s) of level.
    (A) Single-point
    (B) Approximate
    (C) Continuous
    (D) Dual-point

242.4C. Under normal conditions, coagulation:
    (A) None of the above
    (B) Occurs in seconds
    (C) Occurs in hours
    (D) Occurs in minutes

243.102M. If the water rate is $5.50 for the first 500 cu ft and all water used over the minimum
    is billed at a rate of $0.25 per 100 cu ft, how much would a customer using 1200 cu ft be billed?
    (A) $5.25
    (B) $7.25
    (C) $6.75
    (D) $6.25

244.30F. In some filtration plants, the backwash rate (in gallons per minute per square foot)
    required to effectively clean the filter media is greater in summer than in winter. Which of
    the following is the most common reason for this occurrence?
    (A) Because of the lower viscosity of warm water, a higher backwash rate is needed to
        achieve the normal expansion of the filter media
    (B) Higher demands for water in summer require higher filter loadings, which in turn
        require higher backwash rates
    (C) Higher summer temperatures cause filter media particles to swell slightly, thus
        requiring a greater backwash rate to achieve the normal expansion of filter media
    (D) Floc particles adhere more tightly to filter media particles in summer because of
        higher temperatures

245.G105. Adding Alum to water will cause the pH of the water to increase.
    (A) False
    (B) True

246.21MP. Which of the following causes the greatest pipe friction loss?
    (A) Increasing the velocity of wastewater
    (B) Increasing the temperature of the wastewater
    (C) Decreasing the rate of flow
    (D) Decreasing the pressure

247.L39. This acid may be added to MFC plates to make them even more selective - a good idea for samples with high numbers of bacteria.
    (A) Rosalic Acid
    (B) Aniline Blue
    (C) Tartaric Acid
    (D) Lactic Acid

248.3F. Which of the following is not a type of filter?
    (A) Upflow
    (B) Bag
    (C) Pressure
    (D) Sand
    (E) None of the above

249.100MP. When using portable electric tools in damp areas or around standing water, be sure to plug them into a
    (A) Portable power supply
    (B) Ground fault circuit interrupter
    (C) Three-wire to two-wire adapter
    (D) Three-prong outlet

250.50MP. When planning to work on or near electrical equipment, be sure to always _____.
    (A) Remain grounded to metallic equipment
    (B) Handle wires as necessary
    (C) Lock and tag out the equipment
    (D) Notify your electric power provider

251.G52. 1 horsepower = .7457 _____.
    (A) kilowatts
    (B) ft-lbs/min
    (C) watts
    (D) ft-lbs/sec.

252.70M. How many pounds of 65-percent available chlorine equal 2 pounds of 100 percent chlorine.
    (A) 308 pounds
    (B) 5.28 pounds
    (C) 1.30 pounds
    (D) 3.07 pounds

253.R20. When will water suppliers be required to meet the arsenic rule of 10 ug/L?
    (A) There is no final rule so no date has been set.
    (B) It is already in effect.
    (C) January 22, 2001
    (D) January 23, 2006.

254.R4. Community water systems that detect more than 50 ug/L of Arsenic in their water supply after January 23, 2006 must include what information in their consumer confidence report (CCR)?
    (A) Health effects information.
    (B) No information is required since it is below the MCL
    (C) An educational statement.
    (D) Notice of violation and health effects information

255.27W. These two acids are typically used to remove incrusted minerals from well screens.
    (A) Phosphoric
    (B) Caustic
    (C) Sulfamic
    (D) Nitric
    (E) Lime
    (F) Hydrochloric

256.28M. A plant has a 90-ft diameter storage tank with a sidewall depth of 20 ft. The tank also has a conical bottom that is 8 ft deep. The tank has a liquid level of 15 ft (sidewater depth). How many gallons of water are in the tank?
    (A) 112,334
    (B) 840,255
    (C) 713,424
    (D) 586,593

257.34F. The media in a rapid sand filter has an effective size of 0.2 mm. The original
specification was 0.4mm. The cause could be?
- (A) Abrasion over time
- (B) Wrong sand was delivered
- (C) Sand sample was taken off the surface
- (D) All of the above

258.R3. Community water systems that detect between 10 and 50 ug/L of Arsenic in their water
supply after January 23, 2006 must include what information in their consumer confidence
report (CCR)?
- (A) Health effects information.
- (B) Notice of impending violation
- (C) An educational statement.
- (D) No information is required since it is less than ten times the MCL

259.99MP. Hearing protection must be made available to all employees exposed to noise levels above
- (A) 85 decibels at any point in the 8-hour workday
- (B) 850 decibels averaged over 8 working hours
- (C) 85 decibels continuously for 8 working hours
- (D) 85 decibels averaged over 8 working hours

260.11W. Select the best description of the function of a well sounding tube.
- (A) Permits insertion of water level measuring device. Also used to add chlorine or well
cleaning agents.
- (B) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess
air during well recovery period.
- (C) Used to remove first water (usually sandy) pumped at start-up.
- (D) Supports the weight of the pumping unit.
- (E) Permits discharge of air in column pipe during start-up and admits air during shutdown.
- (F) Permits operator to see level of gravel and add gravel as necessary.
- (G) Permits measurement of water level by means of air pressure measurements.
- (H) Provides watertight seal between the motor base and the concrete support pedestal.

261.G13. One mL is what fraction of a L?
- (A) 1/10
- (B) 1/100000
- (C) 1/100
- (D) 1/1000

262.G5. What conditions determine the backwash rate for a pressure filter?
- (A) Quality of the backwash water
- (B) Largest media size
- (C) Settleability of solids in the secondary clarifier
- (D) Suspended solids concentrations in the water applied to the filter

263.L59. When reading the liquid level in a graduated cylinder, one should read from the bottom
of the meniscus at eye level.
- (A) False
- (B) True

264.95MP. Oxygen deficiency becomes a concern when the oxygen level in a confined space is less than
- (A) 25.5%
- (B) 19.5%
- (C) 22.5%
- (D) 28.5%

265.18C. The coagulation process will most likely improve when:
- (A) The temperature of the influent decreases
- (B) The temperature of the influent increases
- (C) The alkalinity of the influent decreases
- (D) The hardness of the influent increases

266.52MP. Which of the following indicates that the impeller of a centrifugal pump may be worn or damaged?
- (A) Pump is delivering too much flow
- (B) Pump is not delivering the design flow
- (C) Impeller speed is too low
- (D) Pump is very cold

267.G26. A wall or plate placed in an open channel and used to measure flow:
- (A) Flow board
- (B) Weir
- (C) Flume
- (D) Baffle

268. G21. One BTU is the unit of measure required to raise the temperature 0f 1 lb. of water by 1 degree f.
    (A) True
    (B) False

269. L41. Calmagite turns blue in the absence of these ions.
    (A) Calcium and Magnesium
    (B) Sodium and Calcium
    (C) Magnesium and Sodium
    (D) All carbonates

270. L68. Temperature does not affect pH measurement.
    (A) True
    (B) False

271. 107M. Scientific notation is a method by which any number can be expressed as a term multiplied by a power of ten, such as 8.75×10^{-2}. Express this number in decimal form.
    (A) 0.875
    (B) 875.00
    (C) 0.0875
    (D) 87.5

272. L67. pH sensors measure the activity of which ion?
    (A) Sodium
    (B) Chlorine
    (C) Caustic
    (D) Hydrogen

273. G23. A pound of water weighs_____lbs.
    (A) 7.48
    (B) 62.4
    (C) 8.34
    (D) None of the above

274. 37M. A settling basin 60' by 12' and 12' deep is used to treat a flow of 2.4 MGD. What is the detention time?
    (A) 15 min.
    (B) 39 min.
    (C) 2.3 hrs
    (D) 1.1 hrs

275. 30M. What is the average detention time in a basin given the following: diameter = 30' depth = 15' flow = 700 gpm
    (A) 1hr. 53min.
    (B) 1hr. 47min.
    (C) 2 hrs. 3 min.
    (D) 1hr. 34min.

276. 89MP. To ensure a safe working atmosphere in a confined space you need a _____?
    (A) Canister respirator, gloves, and hard hat
    (B) Fan to provide ventilation
    (C) Permission from immediate supervisor
    (D) Completed confined space entry permit

277. 38C. Raw water storage helps to minimize the impact of this on water treatment plant performance
    (A) Source water temperature
    (B) Storm events
    (C) Upstream wastewater treatment plants
    (D) Source water pH

278. D21. A chlorine demand test will show the:
    (A) Amount of chlorine required to give a desired residual after a given time
    (B) Number of lbs required to kill 100% of coliforms
    (C) Safe amount of chlorine that may be fed without killing people
    (D) Amount of chlorine required to satisfy the biochemical oxygen demand

279. L18. After drying, filter papers and crucibles should be stored in a _____ to prevent moisture uptake from the atmosphere.
    (A) Dessicator
    (B) Drying oven
    (C) Tupperware container
    (D) Muffle furnace

280.G11. Which of the following pH readings indicates an acidic source water?
        (A) 7
        (B) 12
        (C) 3
        (D) 9

281.53W. What water quality test would confirm whether a well had been contaminated by a nearby
    septic system?
        (A) Residual chlorine
        (B) pH
        (C) Fecal coliform
        (D) Alkalinity

282.70MP. The recommended procedure for mixing concentrated acid with water is:
        (A) Rapidly add acid to water and mix vigorously.
        (B) Rapidly add water to acid and mix vigorously.
        (C) Slowly add acid to water and mix gently.
        (D) Slowly add water to acid and mix gently.

283.97MP. The threshold limit value concentration for chlorine vapor is
        (A) 0.1 ppm
        (B) 1.0 ppm
        (C) 0.3 ppm
        (D) 0.5 ppm

284.24F. When sand in a rapid sand filter becomes dirty, it can be cleaned by?
        (A) Coagulation
        (B) Aeration
        (C) Backwashing
        (D) Filtering

285.28MP.   E=I x R or Votage = Amperage x Resistance is:
        (A) Ohm's law
        (B) Resistance formula
        (C) Ampere
        (D) Theory of relativity

286.14W. Select the best description of the function of a well pump motor base seal.
        (A) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess
            air during well recovery period.
        (B) Permits measurement of water level by means of air pressure measurements.
        (C) Permits discharge of air in column pipe during start-up and admits air during shutdown.
        (D) Supports the weight of the pumping unit.
        (E) Provides watertight seal between the motor base and the concrete support pedestal.
        (F) Used to remove first water (usually sandy) pumped at start-up.
        (G) Permits insertion of water level measuring device. Also used to add chlorine or well
            cleaning agents.
        (H) Permits sampling of pumped water.

287.R16. What is the new MCL for arsenic?
        (A) 10 ug/L (micro grams per liter)
        (B) 50 ug/L (micro grams per liter)
        (C) 5 ug/L (micro grams per liter)
        (D) 25 ug/L (micro grams per liter)

288.L9. A single sample of water taken at one time from one place is called a _____ sample.

        _____

289.D23. In water disinfection, hypochlorination refers to the use of _____ hypochlorite
        (A) Sodium
        (B) Potassium
        (C) Magnesium
        (D) Calcium

290.9M. A flow of 2500 gal/min is equal to how many million gallons per day?
        (A) 7.2 mgd
        (B) 5.0 mgd
        (C) 3.6 mgd
        (D) 2.5 mgd

291.34C. The purpose of the jar test is to determine:
  (A) The amount of chlorine to add for break-point chlorination
  (B) Length of the flash mix
  (C) The correct amount of alum and lime to use for proper coagulation
  (D) The proper amount of mixing and settling time to remove turbidity

292.G14. 9/5(degrees C) + 32 = _____
  (A) Kelvin
  (B) Fahrenheit
  (C) Celsius

293.23F. One of the most common causes of mud balls in the filter media is?
  (A) Broken under drain system
  (B) Insufficient backwash rate
  (C) Excessive backwash rate
  (D) Excessive filtration rate

294.13M. A liquid has a specific gravity of 1.16 How much would 300 gallons of this liquid weigh?
  (A) 2156 pounds
  (B) 348 pounds
  (C) 2901 pounds
  (D) 2603 pounds

295.14M. Eight boxes of packing (for pumps) were delivered. The invoice showed $15.93 each.
    What is the total cost of the packing?
  (A) $1.99
  (B) $127.44
  (C) $106.34
  (D) $95.58

296.L70. What chemical is added to a fecal coliform sample to neutralize residual chlorine?
  (A) Sodium hydroxide
  (B) Sodium thiosulfate
  (C) Potassium chloride
  (D) Sodium azide

297.R22. The Lead and Copper Rule addresses which of the following items:
  (A) I.   Requires water suppliers to use only lead pipes for water distribution
  (B) II. Establishes requirements for lead pipe replacement
  (C) III. Determines action levels for lead and copper in drinking water
  (D) IV. Establishes a treatment technique including corrosion control
  (E) IV only
  (F) II, III, IV

298.79MP. An occupied trench excavation that is 4 ft or deeper must have exits (ladders) at
    intervals of ___ ft.
  (A) 5
  (B) 18
  (C) 50
  (D) 25

299.38W. This type of pump is the most common in water delivery systems because they are able to
    deliver large quantities of water against high or low heads. They are also very efficient.
  (A) Peristaltic
  (B) Positive-displacement
  (C) Rotary lobe
  (D) Screw
  (E) Centrifugal

300.53M. A plastic float is dropped into a water channel and is found to travel 10 feet in 4.2
    seconds. The channel is 2.4 feet wide and is flowing 1.8 feet deep. Calculate the flow rate
    of this wastewater in cubic feet per second.
  (A) 10.3 ft3/sec
  (B) ft3/sec
  (C) 5.7 ft3/sec
  (D) 2.3 ft3/sec
  (E) 4.2 ft3/sec

301.44M. A water plant is equipped with six sedimentation basins that are operated in parallel. Each basin is 30 ft long by 25 ft wide. If the finished water demand is 30 mgd, how many basins need to be on-line to maintain a surface overflow rate of approximately 10 gpm/sft?
    (A) 5
    (B) 3
    (C) 6
    (D) 4
    (E) 2

302.25MP. Instrumentation friction disks or clutch surfaces should be:
    (A) Frequently brushed with a solution of water and soda
    (B) Oiled frequently
    (C) Roughened with emery cloth as necessary
    (D) Kept free of oil

303.D24. Sodium hypochlorite is manufactured by the reaction of gaseous or liquid chlorine with a solution of _____ _____ to produce a liquid containing NaOCl.
    (A) Sodium hydroxide
    (B) Postassium bisulfite
    (C) Sodium azide
    (D) Potassium hydroxide

304.18MP. Valves should be closed slowly to prevent:
    (A) Water hammer
    (B) Excessive head loss
    (C) Excessive wear
    (D) Injury to operator

305.24C. The liquid that stands above a sediment precipitate is referred to as the:
    (A) Effluent
    (B) Sludge blanket
    (C) Supernatant
    (D) Slough

306.33C. Which is NOT a common method for determining optimum coagulant effectiveness?:
    (A) Jar test
    (B) Streaming current detector
    (C) Zeta potential detector
    (D) Colorimetric method

307.G48. When hiring a new operator, a supervisor should select;
    (A) The person with the highest level of education.
    (B) The person with the lowest salary requirement.
    (C) The best communicator.
    (D) The person whose knowledge, skills, and abilities best match the demands of the job.

308.25F. During the backwash cycle, the backwash rate must be high enough to?
    (A) Expand the media to cause the media grains to agitate violently
    (B) Prevent media loss
    (C) Provide for proper bed stratification
    (D) Allow the operator to observe the media

309.L3. _____ can interfere with a turbidity meter measurement.
    (A) pH
    (B) Color
    (C) Temperature
    (D) SS concentration

310.27M. Your system has just installed 2,000 feet of 8" pipe. How many gallons of water will it take to fill it?
    (A) 697.1
    (B) 2,145
    (C) 5,430
    (D) 521.4
    (E) 6,971

311.D30. Under normal conditions, the maximum amount of chlorine gas that can be drawn from a 150-lb cylinder is
    (A) 40 lb/d
    (B) 30 lb/d
    (C) 20 lb/d
    (D) 50 lb/d
    (E) 10 lb/d

312.G101. Free chlorine residuals throughout the distribution system must be:
    (A) Measured annually
    (B) Greater than .50 mg/L
    (C) At least half the entry point residual
    (D) Removed
    (E) Measurable at all times

313.L55. Hardness is defined as the sum of the _____ and ____ ions, although any divalent metal
    ion can contribute to hardness.
    (A) Magnesium and Sodium
    (B) Calcium and Sulfate
    (C) Calcium and Magnesium
    (D) Struvite

314.98M. What horsepower must a pump deliver to water that must be lifted 90 feet? The flow is
    40 gpm.
    (A) 2.0 HP
    (B) 60 HP
    (C) 0.9 HP
    (D) 50 HP
    (E) 76 HP

315.G22. A column of water 12" high and 1 square inch in surface area will produce a pressure of
    _____ lbs.
    (A) 0.433 lbs
    (B) 2.31 lbs
    (C) 62.4 lbs
    (D) 1.0 lb

316.17F. As a general rule, filters must be backwashed when a loss of head differential of ____
    is experienced between the influent and effluent loss-of-head gauges
    (A) 10-12 ft
    (B) 6-10 ft
    (C) 15-17 ft
    (D) 1-2 ft
    (E) 3-5 ft

317.40C. Unlike most surface waters, ground waters may need to have these materials removed
    (A) Iron and manganese
    (B) Iron and copper
    (C) Copper and manganese
    (D) Softening agents

318.82MP. If you need to raise your voice to be heard by someone less than 2 ft away, chances are
    you should be wearing hearing protection.
    (A) False
    (B) True

319.4MP. A pump is delivering at a less than expected rate of discharge. Which of the following
    possible causes is incorrect?
    (A) Clogged impeller
    (B) Motor speed too low
    (C) Pump not primed
    (D) Discharge head too low

320.D27. In the application of chlorine for disinfection, which of the following is not normally
    an operational consideration?
    (A) Mixing
    (B) Contact time
    (C) Dissolved oxygen
    (D) pH
    (E) None of these answers are correct

321.44MP. How often should inactive valves be exercised?
    (A) Daily
    (B) Weekly
    (C) Quarterly
    (D) Monthly

322.71M. How many pounds of 70-percent available chlorine   equal 2 pounds of 100 percent chlorine?
        (A) 2.60 pounds
        (B) 1.40 pounds
        (C) 1.35 pounds
        (D) 2.86 pounds

323.R24. What are the MCLG and Action level for lead in drinking water?
        (A) 15 ppb and 50 ppb
        (B) 10 ppb and 50 ppb
        (C) 0 and 15 ppb
        (D) 15 ppb and 15 ppb

324.23MP. If packing is not maintained properly:
        (A) Pump efficiency will increase
        (B) Cavitation damage will result
        (C) Loss of suction will occur due to air entering the pump
        (D) Impeller will corrode

325.31F. If a filter has been out of service and allowed to go dry, which filter control valve
    should be used to refill it with water?
        (A) Rewash valve
        (B) Solenoid valve
        (C) Wash valve
        (D) Effluent valve
        (E) Influent valve

326.G71. The maximum velocity a venturi flowmeter can measure is
        (A) 10 ft/s
        (B) 1 ft/s
        (C) 10 in/s
        (D) 10 m/s

327.G77. Weirs are most often used to measure flows in
        (A) Pipelines
        (B) Treatment plant intakes
        (C) Underground pipes
        (D) Open channels

328.54MP. Which of the following causes leaking between the segment and body of a plug valve?
        (A) New seal ring
        (B) New seal seating itself
        (C) Overgreased assembly
        (D) Recently-cleaned segment

329.R10. CWS and NTNCWS stand for, _____ and _____ respectively
        (A) County water system and normal, non-county water system
        (B) Community water system and non-transient, non-community water system
        (C) Community waste system and non-transient and non-community waste system
        (D) City water system and national, non-city water system

330.58M. Two wells are used to satisfy demand during the summer months. One well produces water
    that contains 22 mg/L of arsenic. The other well produces water that contains 3 mg/L of
    arsenic. If the total demand for water is 400 gpm and the target arsenic concentration in
    the finished water is 8 mg/L, what is the highest pumping rate possible for the first well?
        (A) 295 gpm
        (B) 160 gpm
        (C) 252 gpm
        (D) 105 gpm

331.L19. If the residue remaining on a filter paper is the suspended solids, these are the solids
    that pass through the filter.
        (A) Dissolved (TDS)
        (B) Non-volatile
        (C) Volatile
        (D) Settleable

332.12W. Select the best description of the function of a well well air line water level
    measuring device.
        (A) Permits discharge of air in column pipe during start-up and admits air during shutdown.
        (B) Provides watertight seal between the motor base and the concrete support pedestal.
        (C) Permits sampling of pumped water.
        (D) Supports the weight of the pumping unit.
        (E) Permits measurement of water level by means of air pressure measurements.
        (F) Permits operator to see level of gravel and add gravel as necessary.
        (G) Used to remove first water (usually sandy) pumped at start-up.
        (H) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess
            air during well recovery period.

333.83M. Determine the setting on a dry alum feeder in pounds per day when the flow is 1.2 mgd.
    Jar tests indicate that the best alum dose is 9 mg/L.
        (A) 100 lbs/day
        (B) 90 lbs/day
        (C) 70 lbs/day
        (D) 75 lbs/day
        (E) 130 lbs/day

334.2M. Five gallons of water weighs
        (A) 41.7 pounds
        (B) 18.9 pounds
        (C) 5.0 pounds
        (D) 37.4 pounds

335.29MP. The ___ is the unit of electrical resistance; resistance to the flow of electrical current.
        (A) Volt
        (B) Ampere
        (C) Ohm
        (D) Watt

336.35C. Optimum coagulant dosage can be established by:
        (A) The breakpoint of chlorination
        (B) Performing total solids tests
        (C) Performing jar tests
        (D) Observing the pilot filter

337.G15. The conductivity of the source water indicates the quantity of dissolved material present.
        (A) False
        (B) True

338.G19. The adherence of a gas, liquid, or dissolved material on the surface of a solid is called:
        (A) Absorption
        (B) Surface tension
        (C) Adsorption
        (D) Capillary action

339.9C. A chemical commonly used for coagulation in water treatment is:
        (A) Soda ash
        (B) Chlorine
        (C) Alum
        (D) Copper sulfate

340.L23. Samples should only be collected where the water is _____ _____.
        (A) Between processes
        (B) Well mixed
        (C) Overflowing weirs
        (D) Standing quietly

341.87MP. To prevent back injuries, follow all of these precautions
        (A) Avoid being overweight
        (B) Warm up before lifting
        (C) Keep fit with exercise
        (D) Practice 12 ounce curls frequently

342.22F. One of the common problems with rapid-sand filters is the formation of mud balls in the filter bed. Since mud balls are difficult to remove after they have formed, it is best to prevent their formation by:
     (A) Having a slow rate of filtration
     (B) Proper backwashing
     (C) Strong chlorination
     (D) Using sodium hexametaphosphate
     (E) Using the proper grade of sand in the filter

343.32W. Polyphosphates are sometimes used to treat wells because they are effective at dispersing all of the following materials.
     (A) Iron and manganese oxides
     (B) Silts
     (C) Iron oxidizing bacteria
     (D) Calcium carbonate deposits
     (E) Chloramines
     (F) Iron and manganese hydroxides
     (G) Clays

344.D17. As water temperatures decrease, the disinfecting action of chlorine:
     (A) Remains the same
     (B) Decreases
     (C) Depends on the altitude
     (D) Increases

345.46M. At what rate in gpm must wash water be delivered to a mixed media filter to attain a backwash rate of 15 gpm/sq ft if the filter is 20' wide and 30' long.
     (A) 9000
     (B) 3000
     (C) 600
     (D) 2400

346.39C. Disinfection with chlorine may cause the formation of these compounds. They are a result of chlorine binding to naturally occuring organic matter.
     (A) Trichloramines
     (B) Trihalomethanes
     (C) CFCs
     (D) Chloroalkali salts

347.L46. Calculate the standard percent recovery if the analytical result is 35 mg/L and the certified true value is 39.5 mg/L
     (A) 112.8%
     (B) 92.0%
     (C) 88.6%
     (D) 13.2%

348.77M. A water company uses an average of 600 gpm. The water contains 0.30 mg/L of manganese and 0.06 mg/L of iron. How many pounds of iron and manganese combined are pumped into the distribution system in a year?
     (A) 2.52 pounds
     (B) 789 pounds
     (C) 947 pounds
     (D) 400 pounds

349.L22. The two basic types of samples are _____ and _____?

     _____

350.37F. A water treatment plant produces 850,000 gal of water per day. On one day 24,526 gal was used for backwashing the filters. What was the net production for this day?
     (A) 604,740 gal
     (B) 406,740 gal
     (C) 825,474 gal
     (D) 746,604 gal

351.54M. You are preparing a stock solution using dry sodium bicarbonate. Your desired strength is 5,000 mg/L so that 1 ml of stock solution per 1,000 ml sample water produces 5mg/L. How many dry grams must you add to your 1 Liter of stock solution dilution water?
     (A) 0.5
     (B) 0.05
     (C) 500
     (D) 5.0

352.G55. Agglomeration of colloidal and finely divided suspended matter after coagulation by
    gentle mixing is called what?
        (A) Ballasting
        (B) Sedimentation
        (C) Flocculation
        (D) Polymer accretion

353.R14. What does PWS stand for?
        (A) Private Water System
        (B) Public Water System
        (C) Public Water Supplier
        (D) Private Water Supplier

354.18M. Your Water plant treats water at a rate of 700 GPM. How many MGD is this?
        (A) 0.420 MGD
        (B) 1.800 MGD
        (C) 0.1008 MGD
        (D) 1.008 MGD
        (E) 0.700 MGD

355.G106. A water with a pH value of 7.00 is considered to be:
        (A) Neutral
        (B) Basic
        (C) Cold
        (D) Acidic
        (E) Hot

356.G107. "Mudball" accumulation in filter media is an indication of:
        (A) Excessive turbidity removal
        (B) Normal Operations
        (C) Ineffective backwashing
        (D) Desirable contaminant removal
        (E) Improper filter media

357.110M. You have replaced 3/4 of the water meters in your system. You have a total of 540. How
    many will you need to complete the task of replacing all the meters?
        (A) 275
        (B) 135
        (C) 54
        (D) 405
        (E) 195

358.G41. When a great deal of authority is delegated on many levels, an organization may be
    described as:
        (A) Authoritarian
        (B) Unstructured
        (C) Centralized
        (D) Decentralized

359.L30. Control charting consists of _____ data and then _____ it on a graph.
        (A) Collecting, Plotting
        (B) Selecting, Not Plotting
        (C) Making up, Plotting
        (D) Making up, Not Plotting

360.6MP. The casing surrounding a pump impeller that collects the water discharged by the
    impeller is called a _____.
        (A) Impeller casing
        (B) Stuffing Box
        (C) Volute
        (D) Wear Ring

361.L47. This type of quality control sample is used to check for interferences.
        (A) Duplicate
        (B) Spikes
        (C) Standards
        (D) Blanks

362.89M. The raw water alkalinity is 50 mg/L as calcium carbonate. The water is treated by
adding 15 mg/L of alum. What is the alkalinity concentration of the finished water?
(A) 57.5 mg/L
(B) 65.0 mg/L
(C) 35.0 mg/L
(D) 42.5 mg/L

363.3W. Limestone is more or less porous than clay.
(A) They are about the same
(B) Less
(C) More

364.8C. The three most commonly used coagulants in water treatment are:
(A) Aluminum hydroxide, lime and sodium hydroxide
(B) Aluminum sulfate, ferric chloride, and ferrous sulfate
(C) Soda, lime and chlorine
(D) Lime, sodium hydroxide, and chlorine

365.19MP. If a centrifugal pump loses its prime after starting, what is the most probable cause?
(A) Air pocket in the discharge line
(B) Air leaks into the pump through stuffing boxes
(C) Speed to high
(D) Foreign matter in the impeller

366.7F. Dual-media and multimedia filters
(A) Do not require backwashing
(B) Cannot reduce turbidity
(C) Can operate at three or four times the rate of sand filters
(D) Require an extremely deep bed

367.G2. Indigo Water Group may be contacted in any of the following ways. Select all that apply.
(A) By thinking real hard and waiting for our clarivoyant response
(B) Telephone at (303)489-9226
(C) Snail mail at Indigo Water Group, 626 W. Davies Way, Littleton, CO 80120
(D) Through our web site at www.indigowatergroup.com
(E) By yelling really loud from the top of a tall building
(F) E-mail at sidneyb@indigowatergroup.com

368.67M. How many lbs/day chlorine will be used if the flow is 7,000,000 gpd and a uniform dose
of 1.2 mg/l is applied?
(A) 22 lb
(B) 70 lb
(C) 26 lb
(D) 15 lb

369.R23. The Lead and Copper Rule is currently in effect.
(A) True
(B) False

370.G20. A manometer measures:
(A) Pressure
(B) Liquid levels
(C) Gas volume

371.74M. How much sodium hypochlorite, in gallons, is required to obtain a residual of 100 mg/L
in a well? The casing diameter is 18 inches and the length of water filled casing is 80
feet. Sodium hypochlorite contains 5.25% available chlorine. Assume a demand of 15 mg/L.
(A) 23.0 gallons
(B) 16.8 gallons
(C) 2.0 gallons
(D) 2.3 gallons

372.G7. The precipitate formed by coagulation with alum is aluminum _____.
(A) Bicarbonate
(B) Hydroxide
(C) Sulfate
(D) Carbonate

373.G17. _____ is the measure of how much acid can be added to a liquid, without causing a great change in pH.
    (A) Hardness
    (B) Alkalinity
    (C) Acidity
    (D) pH

374.D8. The least potent, but longest lasting form of chlorine residual is the _____ residual.
    (A) Total
    (B) Free
    (C) Combined

375.L8. _____ solids, extremely fine particles, will not settle from the liquid portion, but can usually be filtered from the liquid with a 0.45-um membrane filter.
    (A) Colloidal
    (B) Settleable
    (C) Suspended
    (D) Dissolved

376.G97. Coliform bacteria are:
    (A) Highly resistant to chlorine
    (B) Indicator organisms
    (C) Deadly
    (D) Commonly found throughout distribution systems
    (E) Desirable in storage tanks for iron digestion

377.56MP. Why should standby generators be exercised regularly?
    (A) To save money on plant electrical costs
    (B) To test the system under actual conditions
    (C) To train new operators on generator operation
    (D) To supply extra power when needed

378.26W. All of these methods may be used to clean well casings and screens. Check all that apply.
    (A) Polyphosphate treatment
    (B) Explosive charges
    (C) Wire brushing
    (D) Surging
    (E) Base treatment
    (F) High-velocity jetting

379.75M. A chemical feed pump has been rebuilt and must be calibrated for maximum pump rate. If it takes 1 hour and 15 minutes to fill a 10-ft X 5-ft X 10-ft rectangular tank, what is the maximum pump rate in gal/min?
    (A) 38 gal/min
    (B) 45 gal/min
    (C) 50 gal/min
    (D) 67 gal/min

380.G38. When purchased materials are received by the utility they should be:
    (A) Distributed as soon as possible
    (B) Assumed to be in working order
    (C) Placed on shelves
    (D) Counted and checked against the purchase order

381.D1. Chlorine demand = _____ - chlorine residual.

_____

382.72MP. When a fire hydrant is operated, it should be:
    (A) Regulated to flow required
    (B) Opened halfway
    (C) Opened enough to have flow
    (D) Opened fully

383.R29. What are the MCLs for nitrites and nitrates?
    (A) 1 ppm and 10 ppm respectively
    (B) 10 ppm and 1 ppm respectively
    (C) 1 ppb and 10 ppb respectively
    (D) 10 ppb and 1 ppb respectively

384.G90. The company to contact for updates and corrections to the PEST wastewater question
database is
   (A) Indigo Water Group
   (B) 450 Decatur Street, Denver Colorado 80110
   (C) Main Line is (303)825-1802
   (D) Contact: Sidney Biesterfeld at ext. 48

385.G95. Under current regulation effluent turbidity must be measured every:
   (A) Weekly
   (B) Quarterly
   (C) 4 hours
   (D) Every 15 minutes
   (E) Daily

386.D44. A chlorine injecter works by:
   (A) Pumping liquid chlorine from the bottom of the cylinder into the wastewater
   (B) Literally squirting chlorine into the wastewater with a little pump
   (C) Creating a vacuum that draws the chlorine out of the cylinder.
   (D) Pumping gaseous chlorine from the top of the cylinder into the wastewater

387.94M. A centrifugal pump is pumping 200 gal/min against a 40-foot total pumping head. The
approximate output power of is 2 HP. What will the output power be if the pumping head
increased to 60 feet?
   (A) 1 hp
   (B) 8 hp
   (C) 2 hp
   (D) 3 hp

388.32MP. If bearings on a centrifugal pump are running hot, over- or under lubrication should be
checked. If lubrication is satisfactory, the next preventative maintenance check would be to
   (A) Replace the bearings
   (B) Inspect the alignment of the pump and motor
   (C) Clean the pump
   (D) Operate the pump only when needed
   (E) Recheck the total dynamic head

389.72M. If 1,000,000 bacteria are exposed to a disinfectant and 90 percent are destroyed every
hour, then fewer than 5 bacteria will remain after
   (A) 6 hours
   (B) 7 hours
   (C) 4 hours
   (D) 24 hours
   (E) 5 hours
   (F) 3 hours

390.G3. Source waters include these two broad categories
   (A) Flowing water and stagnant water
   (B) Reservoirs and ground water
   (C) Reservoirs and wells
   (D) Surface water and ground water

391.26C. With the coming of winter, the water temperature drops. A likely operational problem at
a filtration plant with coagulation is:
   (A) High alkalinity
   (B) Odor
   (C) Floc carryover from the sedimentation system
   (D) High chlorine residual

392.35M. Given the following information, what is the water tank detention time? Diameter = 80 ft
   Depth = 25 ft   Flow rate = 25000 gpd
   (A) 25.2 days
   (B) 37.6 days
   (C) 47.8 days
   (D) 15.7 days

393.L27. Both of these quality control samples can be used to measure accuracy and precision.
   (A) Duplicates and Spikes
   (B) Standards and Duplicates
   (C) Blanks and Standards
   (D) Blanks and Duplicates

394.58MP. How often should the packing on a gate valve be replaced?
        (A) Monthly
        (B) As required
        (C) Annually
        (D) Weekly

395.37C. Drag and drop the following conventional unit processes into their correct order in a water treatment plant.
        (A) Filtration
        (B) Settling
        (C) Flocculation
        (D) Coagulation
        (E) Treated water storage

        Arrange in proper sequence: _____

396.53MP. A ground fault interrupter on an electrical circuit system is used to _____.
        (A) Provide an extra ground line for a circuit
        (B) Disconnect power from the circuit if there is a faulty ground line
        (C) Interrupt repairs if the circuit is live
        (D) Divert power to a new circuit if the present circuit is damaged

397.1M. One cubic foot of water contains
        (A) 7.48 gallons
        (B) 3.785 gallons
        (C) 8.34 gallons
        (D) 62.4 gallons

398.39MP. The difference in water surface elevation between where the pump is pulling from and where it is discharging to is called the _____ head.
        (A) Suction
        (B) Static
        (C) Dynamic
        (D) Discharge

399.L48. Duplicates should agree with their original samples by this margin.
        (A) Plus or Minus 20%
        (B) Plus or Minus 10% Relative Percent Difference
        (C) Plus or Minus 20% Relative Percent Difference
        (D) Plus or Minus 10%

400.25C. Overcoming problems of cold-water floc can be corrected by operating the process at the best pH for that water temperature, increasing the coagulant dosage, or:
        (A) Adding weighting agents
        (B) Performing the jar test
        (C) Increasing the detention time for floc formation
        (D) Increasing the number and strength of floc particles

401.G50. The solubility of air into water decreases with pressure.
        (A) False
        (B) True

402.G35. A thin plate with a hole in the middle used to measure flow is called _____.
        (A) An orifice plate
        (B) A pinhole weir
        (C) A venturi restriction
        (D) A parshall flume

403.84M. The average daily flow for a water treatment plant is 0.95 mgd. Jar tests indicate that the best polymer dosage is 2.2 mg/L. How many pounds of polymer will be used in 30 days?
        (A) 260 lbs
        (B) 412 lbs
        (C) 437 lbs
        (D) 340 lbs
        (E) 523 lbs

404.87M. A flow of 1.2 mgd will be treated with an 18-percent solution of hydrofluosilicic acid. The raw water does not contain any fluoride and the desired fluoride concentration is 1.4 mg/L. Assume that the hydrofluosilicic weighs 9.5 pounds per gallon and 79.2 percent of the solution is available fluoride. Calculate the hydrofluosilicic acid feed rate in gallons per day.
    (A) 5.8 gpd
    (B) 14.5 gpd
    (C) 10.3 gpd
    (D) 12.9 gpd
    (E) 11.6 gpd

405.G103. In turbidity measurement, the abbreviation "NTU" stands for:
    (A) Nitrification Treatment Unit
    (B) Nephelometric Treatment Usage
    (C) Norton Turbidity Unit
    (D) Not Too Ugly
    (E) Nephelometric Turbidity Unit

406.29M. The flow velocity in a 6-in. diameter pipe is twice that in a 12-in diameter pipe if both are carrying 50 gal/min of wastewater.
    (A) False
    (B) True

407.G25. The height of water above a point measured in either pounds per square inch or height is called _____.

_____

408.G58. A device used for quick, uniform dispersal of a chemical throughout a liquid is called a what?

_____

409.4F. What type of filter is most commonly used in surface-water treatment?
    (A) Pressure filters
    (B) Zeolite filters
    (C) Slow sand filters
    (D) Rapid sand filters
    (E) Diatomaceous earth filters

410.51M. What is the approximate volume of flow (MGD) treated in a 7 ft wide, 4 ft deep chamber, if a floating stick moves 24 inches in 30 seconds.
    (A) 4.52 MGD
    (B) 1.21 MGD
    (C) 1.37 MGD
    (D) 5.42 MGD

411.43M. A circular tank receives 12.5 mgd of flow and has a SOR of 100 gpm/ft. What is the diameter of the tank?
    (A) 27.6 ft
    (B) 75.0 ft
    (C) 14.7 ft
    (D) 10.5 ft

412.51MP. What is your first course of action if you see a slow constant drip from a pump shaft packing seal?
    (A) Make no adjustment
    (B) Loosen the gland nuts
    (C) Fill seal with more water as needed
    (D) Change/adjust packing material

413.14MP. In a centrifugal pump, leakage is prevented by
    (A) Sleeves
    (B) Volutes
    (C) Impellers
    (D) Wear rings

414.R6. About 90 percent all arsenic used in the United States is used for this purpose
    (A) Fighting forest fires
    (B) As a colorizer for highway paint
    (C) Poisoning rats and other small mammals
    (D) Wood preservative

415.L40. Distilled water must be used for dilutions in most analyses to prevent this problem.

   _____

416.G56. A thermocouple measures what?
      (A) Wind speed
      (B) Vibration
      (C) Pressure
      (D) Temperature

417.G85. The time it takes for a unit volume of water to pass entirely through a sedimentation
basin is called
      (A) Weir loading rate
      (B) Hydraulic loading rate
      (C) Detention time
      (D) Overflow time

418.29W. Chlorine treatment of wells is sometimes referred to as _____ treatment because of
the high concentrations of chlorine used; between 100 and 200 mg/L.
      (A) Chloro-biotic
      (B) Attenuated
      (C) Slug
      (D) Shock

419.8M. You have a water storage tank that is 90' tall and 45' in diameter, it currently has 56'
of water in it, what is the pressure in the bottom of the tank
      (A) 100 psi
      (B) 24.2 psi
      (C) 56 psi
      (D) 2 psi
      (E) 14 psi

420.G88. Magnetic flow meters work on which of the following principles of operation?
      (A) The volume of water that can be moved by an electromagnet.
      (B) The volume of water required to separate two magnets.
      (C) The reduction in magnetic pull as the volume of water separates a magnet and plug.
      (D) Magnetic induction where voltage is generated in a magnetic field and converted to a velocity.

421.8W. The following parameters should be recorded and tracked by water operators for each well
in their system. Check all that apply.
      (A) Air temperature
      (B) Pumping amounts and dates
      (C) Water quality results
      (D) Time of pumping

422.21C. Sedimentation is improved by:
      (A) A sludge blanket that acts as a physical filter for incoming solids
      (B) Uniform, horizontal, low-velocity flow across the basin
      (C) Short circuiting
      (D) Reducing the detention period

423.D45. Remote vacuum chlorine injectors use this type of injector:
      (A) Genoa fine tip
      (B) Centrifugal
      (C) Venturi
      (D) Cardinal

424.G68. Most circuit breakers are rated at what percentage of motor amperage?
      (A) 10%
      (B) 25%
      (C) 100%
      (D) 125%
      (E) None of these answers are correct

425.G63. A bed of sand through which water is passed to remove fine suspended particles is called what?

   _____

426.34M. If two pumps will pump 120 gpm each, how long will it take to fill a tank 50' long, 20' wide, and 8' deep?
    (A) 4 hours, 9 minutes
    (B) 2 hours, 27 minutes
    (C) 1 hour, 49 minutes
    (D) 4 hours, 42 minutes

427.G84. A force main is a section of gravity-flow pipeline leading from a lift station.
    (A) True
    (B) False

428.102MP. When mixing dry sodium hydroxide and water in an enclosed vessel or area, be sure that
    (A) You add the water rapidly
    (B) The vessel or area is properly vented
    (C) Mix the solution by agitation only
    (D) The vessel or area is properly heated

429.L14. Another word for the average is the _____?
    (A) Mean
    (B) Geometric mean
    (C) Norm
    (D) Highest probability

430.42M. Find the surface overflow rate in gpd/ft2 for a circular tank. The tank is 40 feet in diameter and the influent flow rate is 4 mgd.
    (A) 1760 gpd/ft2
    (B) 796 gpd/ft2
    (C) 3185 gpd/ft2
    (D) 1325 gpd/ft2

431.L10. All those combinations of elements that do not include organic carbon are called what?
    (A) Vitriolic
    (B) Inorganic
    (C) Sedimentary
    (D) Polymeric

432.27MP. What separates the impeller from the volute and prevents backflow in a centrifugal pump?
    (A) Stuffing box
    (B) Impeller shaft
    (C) Water seal
    (D) Wear rings

433.G86. Which of the following is a typical piece of flow measuring equipment?
    (A) Counterweighted float-level indicator
    (B) Nephelometer
    (C) Parshall flume
    (D) Downward looking acoustic sensor

434.92MP. The first step the maintenance staff should take in properly locking and tagging out a piece of equipment is to _____.
    (A) Turn the equipment off at the motor control center (MCC)
    (B) Fill out the tags
    (C) Alert the operator on duty
    (D) Pull the switch on the electrical panel to "off"

435.22M. Approximately how many gallons would 600 ft of 6" pipe hold?
    (A) 880
    (B) 740
    (C) 930
    (D) 900

436.15F. The most important factor in evaluating filter performance is?
    (A) Mud ball formation
    (B) Effluent turbidity
    (C) Head loss
    (D) Filter loading rate

437.G74. Which of the following is not a basic backflow prevention device?
    (A) None of these answers are correct
    (B) Corporation stop
    (C) Double check-valve assembly
    (D) Reduced pressure principle device

438.D19. Chlorine residual may be determined using the reagent:
     (A) Polychlorinated biphenyls
     (B) Sodium thiosulfate
     (C) Diethyl-p-phenylene diamine
     (D) Ethylene diamine tetraacetic acid

439.G89. What is the primary operational concern for using a float-level indicator in an open channel?
     (A) Solids, debris, or ice
     (B) The type of counterweight used
     (C) Heavy flows
     (D) Turbulent flows

440.L78. Coliforms are used as indicator bacteria to verify the effectiveness of disinfection
     techniques because _____.
     (A) They have a symbiotic relationship with pathogens; one cannot survive without the other.
     (B) They cause the worst diseases of any of the wastewater pathogens
     (C) They are easier to detect and are harder to destroy than most pathogenic organisms
     (D) They are the most numerous of all wastewater pathogens

441.9F. When mixed media filters composed of garnet, sand, and crushed anthracite coal are used,
     which of the following describes their placement in the filter bed?
     (A) Sand on top, anthracite coal in the middle, and garnet on the bottom
     (B) Anthracite coal on top, garnet in the middle, and sand on the bottom
     (C) Anthracite coal on top, sand in the middle, and garnet on the bottom
     (D) Garnet on top, anthracite coal in the middle, and sand on the bottom

442.19M. Find how many gallons of liquid are in a tank which measures 40' long, 25' wide and 12' high.
     (A) 79872
     (B) 67859
     (C) 89760
     (D) 90272

443.G81. What effect does temperature have on oxygen solubility?
     (A) No effect
     (B) As temperature increases, dissolved oxygen levels decrease
     (C) As temperature decreases, dissolved oxygen levels decrease

444.G6. If your finished water turbidity changed from 0.2 NTU to 0.8 NTU and you do not want to
     change the pH, what chemical would you use?
     (A) Sodium aluminate
     (B) Polymer
     (C) Ferric chloride
     (D) Alum

445.D20. A malfunctioning gas chlorination system has normal gas pressure, no feed rate indicated
     on the rotometer, and no injector vacuum. What is the most likely cause of the problem?
     (A) Air leak upstream of the rotometer
     (B) Gas line plugged
     (C) Pressure reducing valve diaphragm ruptured
     (D) Injector clogged

446.G1. The creators of this database, and another database for wastewater treatment plant
     operators, work for the folling company:
     (A) Indigo Water Group
     (B) Integra Engineering
     (C) Vellosoft
     (D) Microsoft
     (E) Forbes
     (F) Both A and B are correct.

447.10W. Select the best description of the function of a well gravel tube.
     (A) Supports the weight of the pumping unit.
     (B) Provides watertight seal between the motor base and the concrete support pedestal.
     (C) Permits operator to see level of gravel and add gravel as necessary.
     (D) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess
         air during well recovery period.
     (E) Used to remove first water (usually sandy) pumped at start-up.
     (F) Permits measurement of water level by means of air pressure measurements.
     (G) Permits discharge of air in column pipe during start-up and admits air during shutdown.
     (H) Permits sampling of pumped water.

448.8F. In a filter using gravel, anthracite, and sand, the anthracite should be?
        (A) Between the sand and the gravel
        (B) Beneath the gravel
        (C) Mixed with the sand
        (D) The top layer of media

449.G93. NTU stands for
        (A) Nominal Turbidity Unit
        (B) Nominal Tubidity Utilization
        (C) Nephelometric turbidity unit
        (D) Nephelometric total solids utilization
        (E) Nepelometric turbidity utilization

450.6F. Slow sand filters are most useful
        (A) In systems that have limited land area to operate
        (B) After chemical coagulation
        (C) In large systems with poor surface water quality
        (D) Where low construction, maintenance, and operating costs are important

451.L33. Control charts allow us to look for _____ as well as out of limits conditions.

_____

452.L63. What is the most common preservation method for samples?
        (A) Cooling to 4 deg. C
        (B) Dechlorination
        (C) Reduction
        (D) Acidification

453.83MP. Loudness, length of exposure, and distance from the noise source are factors in
    determining if a noise is hazardous enough to damage hearing.
        (A) False
        (B) True

454.80M. Your water plant feeds 25% caustic soda (containing 2.67 lbs.dry/gallon) for final pH
    adjustment. Historic records show your average dose is 6.5 mg/L and average flow is 310 GPM.
    At this rate how many 55 gallon drums will you use in 1 year?
        (A) 33.1 drums
        (B) 120 drums
        (C) 24.2 drums
        (D) 60.1 drums
        (E) 88.3 drums

455.10C. The chemical symbol for the most common coagulant used in water treatment, aluminum
    sulfate (alum), is:
        (A) NH3(OH)7
        (B) Al2(OH)6
        (C) Fe2(SO4)3
        (D) Al2(SO4)3

456.24MP. Information on preventive maintenance procedures, materials, and frequencies for plant
    structures should be taken from:
        (A) Lab records
        (B) Who needs books? we don't need no stinkin' books!
        (C) Manufacturers operation and maintenance manuals
        (D) Experience at the plant
        (E) As-built blueprints

457.3MP. Cavitation is the formation and collapse of a gas pocket or bubble on the blade of a
    pump's impeller.
        (A) True
        (B) False

458.D4. 4 mg/l of chlorine is added continuously to a water flow that averages 5 MGD. How many
    lbs. chlorine will be used in 30 days?
        (A) 5000 lb.
        (B) 3000 lb.
        (C) 1500 lb.
        (D) 15000 lb.

459.L21. Control charts are only effective if they are _____ and _____.
     (A) Pretty and Available
     (B) Current and Colorful
     (C) Current and Available
     (D) Accurate and Contain a lot of data points

460.L54. Alkalinity is defined as the _____ capacity of a water.

    _____

461.L4. Total solids can be divided into suspended solids and _____ solids.
     (A) Colloidal
     (B) Settleable
     (C) Dissolved
     (D) Filterable

462.D37. The maximum rate for withdrawing gaseous chlorine from a 1-ton tank at room temperature is
     (A) 20 lb/h
     (B) 10 lb/h
     (C) 7 lb/h
     (D) 15 lb/h

463.65M. How many pounds of calcium hypochlorite are there in 15 lbs of 65% calcium hypochlorite solution?
     (A) 9.75 pounds
     (B) 24.75 pounds
     (C) 23.07 pounds
     (D) 5.25 pounds

464.85MP. Because actual conditions vary from one worksite to another, the selection of an appropriate respirator weighs heavily on all of these variables. Check all that apply.
     (A) The presence or absence of sufficient oxygen
     (B) The odor threshold value of the ambient air
     (C) Comfort of the person wearing the equipment
     (D) The size of the particles to be filtered

465.D34. If a 100-mgd flow of water is dosed at a rate of 12 mg/l, what should the chlorine-feed setting be to the nearest 100 lb/d?
     (A) 10,000
     (B) 1000
     (C) 12,000
     (D) 1200

466.1C. Which is the best method to remove sand from water?
     (A) Add lime
     (B) Provide a settling tank
     (C) Aerate
     (D) Use zeolite softening

467.19F. When cold water starts to warm up, a condition that can occur in the media of a filter is called?
     (A) Mudballing
     (B) Jet action
     (C) Air binding
     (D) Bed shrinkage

468.14F. Head loss, filter-effluent turbidity, and length of filter run are each considered independently in determining
     (A) When a filter needs backwashing
     (B) The benefits of using filter aids
     (C) Filter flow rates
     (D) The frequency of media replacement

469.45MP. A water-filled mechanical pump seal not only helps to prevent leaks, but also
     (A) Keeps the pump primed
     (B) Cools the material being pumped
     (C) Acts as a lubricant for the pump shaft
     (D) Acts as a reserve water supply

470.95M. A single-piston reciprocating pump has a 6" diameter piston with a 6" length of stroke. It makes 16 discharge strokes/min, the pumping rate is _____gpm.
    (A) 12
    (B) 47
    (C) 6
    (D) 25

471.R28. What are nitrites and nitrates?
    (A) They are nitrogen-oxygen chemical units that combine with various organic and inorganic compounds.
    (B) They are non-radioactive isotopes of nitrogen with half-lives of 225 years and 128 years, respectively.
    (C) They are two types of nitrogen used in water treatment.
    (D) They are alternative chemicals used in corrosion control strategies.

472.D2. A total residual is also referred to as a _____ residual.

_____

473.G102. Groundwater in comparison to surface water is generally:
    (A) More susceptible to algal blooms
    (B) Lower in turbidity and higher in mineral content
    (C) Warmer and is quite soft
    (D) Higher in turbidity and lower in mineral content
    (E) More susceptible to seasonal changes

474.99M. If the required water horsepower of a pump is 50 HP, what must the motor horsepower be if the efficiency of the pump is 75 percent and the efficiency of the motor is 90 percent?
    (A) 111 HP
    (B) 50 HP
    (C) 89 HP
    (D) 40.5 HP
    (E) 74 HP

475.G104. Overgreasing of an electric motor:
    (A) Will cause the motor to overheat
    (B) Will cause the motor to run cooler
    (C) Will cause the motor to run smoother
    (D) Will cause the motor to draw less power at startup
    (E) Cannot be done

476.68M. One gallon of sodium hypochlorite laundry bleach (with 5.25% available chlorine) contains:
    (A) 4.38 pounds of active chlorine
    (B) 0.44 pounds of active chlorine
    (C) 0.39 pounds of active chlorine
    (D) 0.053 pounds of active chlorine

477.45W. After a routine repair to an existing well, how much chlorine residual is required in the well to ensure adequate disinfection?
    (A) 200 mg/L
    (B) 400 mg/L
    (C) 1000 mg/L
    (D) 100 mg/L

478.L65. pH sensors consist of
    (A) A glass electrode and reference electrode
    (B) A pH electrode and temperature electrode
    (C) A junction electrode and null electrode

479.G4. "Uniformity coefficient" refers to:
    (A) Uniform floc formation
    (B) Quality of wastewater
    (C) Measure of uniformity of filter media
    (D) Running the test the same way each time

480.35MP. A treatment plant should have a valve exercise program in which all plant valves are exercised (opened and closed)
    (A) Once every 10 years
    (B) Once a year
    (C) Once every 20 years
    (D) Once every 2 years

481.L35. Fecal colonies take on a blue appearance from drawing up this component from the MFC media.
    (A) Blue dye no. 5
    (B) Aniline Blue Dye
    (C) Rosalic Acid
    (D) Lactose

482.26F. If impurities are observed in the filter bed of a rapid sand filter during backwashing procedures, the probable cause is:
    (A) The condition is normal for such filters
    (B) No surface wash
    (C) Insufficient backwash rate
    (D) Excessive backwash rate

483.L53. Alkalinity and hardness are both analyzed by adding a known reagent to the sample. This process results in a _____ change.

    _____

484.G57. A laboratory procedure for evaluating coagulation, flocculation, and sedimentation is called what?

    _____

485.35F. When a filter wash is uneven, the spots violently over washed might result in which of the following?
    (A) Cause an increase in the sand effective size
    (B) Cause the sand grains in this area to cement together
    (C) Overturn the gravel layer, allowing sand to displace it
    (D) Increase the free board distance in this area

486.L58. Sample refrigerators should be set at _____ degrees C plus or minus 2 degrees C for proper preservation.
    (A) 2
    (B) 0
    (C) 4
    (D) 6

487.65MP. A well pump is requiring more power than it should. The impellers are properly adjusted and the well was recently cleaned. What is the most likely cause of increased power draw?
    (A) Worn bearings or bent shaft
    (B) Line shaft bearings not receiving oil
    (C) Impellers are worn
    (D) Drawdown more than anticipated

488.16C. A coagulant aid is a chemical added during coagulation to improve coagulation; to build stronger, more settleable floc; to overcome the effects of temperature drops; to reduce the amount of coagulant needed, and/or to reduce the amount of sludge produced. Which of the following is not a type of coagulant aid:
    (A) Activated silica
    (B) Polyelectrolytes or polymers
    (C) Green sand
    (D) Weighting agents

489.L79. Most DO probes come with an electronic zero for calibration. What should be used to check the accuracy of this feature on a DO probe?
    (A) Sodium sulfite solution
    (B) Septic sludge
    (C) Winkler DO test
    (D) Fresh water

490.94MP. When manually lifting any object, be sure to _____.
    (A) Keep your back bent and hold it low
    (B) Hold it at arm's length
    (C) Keep it close to your body and use leg strength
    (D) Keep your knees locked and bend at the waist

491.G75. An example of a "single-use" plan is a(n)
    (A) Budget
    (B) Chronological sequence of performance acts
    (C) Regulating principle or directive
    (D) Indication of exactly how each step is to be carried out

492.73M. Determine the chlorinator setting in pounds per 24 hours if a well pump delivers 300 gpm and the desired chlorine dose is 2.0 mg/L.
    (A) 4.8 ppd
    (B) 12.0 ppd
    (C) 6.5 ppd
    (D) 7.2 ppd

493.42MP. What is the vertical distance between the elevation of the free water surface at the suction and that of the free water surface at the discharge of a pump called?
    (A) Velocity head
    (B) Discharge head
    (C) Static head
    (D) Dynamic head

494.D22. One ton chlorine cylinders:
    (A) Have fusable plugs located at valves
    (B) Remove liquid chlorine from the top valve
    (C) Must be stored in an upright position
    (D) Use the bottom valve only with chlorine evaporators

495.G65. Which one of the following statements is true in regard to the concept of pH?
    (A) A raw water sample with a pH of 6.5 is slightly basic.
    (B) A pH meter gives the percent hydrogen ion concentration as its direct readout value.
    (C) Accurate pH measurements on raw water require that a 24-hour flow-proporational sample be collected.
    (D) pH indicates the amount of total alkalinity available.
    (E) The range of pH is between 0 and 14

496.G96. Before iron, manganese, and hydrogen sulfide can be removed by filtration they must first be converted to:
    (A) Insoluable precipates through oxidation
    (B) Gases through adequate detention time
    (C) Gases through flash mixing
    (D) An odor free state through settling

497.28W. Chlorine is an effective treatment for well screens. It helps to remove this material.
    (A) Calcium carbonate deposits
    (B) Iron and manganese oxides
    (C) Slime from iron-oxidizing bacteria
    (D) Biofilms from ammonia-oxidizing bacteria

498.R12. Which statement best describes a Community Water System?
    (A) A small private water system that sells bottled water to consumers.
    (B) A public water system that serves at least 25 of the same people more than 6 months of the year.
    (C) A public water system that serves at least 15 locations or 25 residents regularly, year round.
    (D) A large public water system.

499.7C. In order for a substance to function satisfactorily as a coagulant, it must:
    (A) React with lime
    (B) Remove taste and odor
    (C) Affect pH
    (D) Produce a water insoluble floc

500.47M. Your filter filters at a rate of 200 GPM. On your last filter run you filtered 728,000 gallons of water before backwashing. How many hours did this filter run?
    (A) 6.1 hours
    (B) 60.7 hours
    (C) 36.4 hours
    (D) 3,640 hours
    (E) 607 hours

501.10M. Regardless of shape, 1 ac-ft of water is equal to
    (A) 55,560 ft3
    (B) 77,840 ft3
    (C) 43,560 ft3
    (D) 33,000 ft3

502.G78. Photosynthesis is the conversion of ____ to _____ by algae using sunlight for energy.
    (A) Carbon dioxide to water
    (B) Carbon dioxide to ammonia
    (C) Carbon dioxide to oxygen
    (D) Carbon dioxide to methane

503.L15. The acronym RPD stands for what?
    (A) Ranked Percent Difference
    (B) Relative Probable Difference
    (C) Ranked Probable Difference
    (D) Relative Percent Difference

504.98MP. In addition to the worker entering a confined space, what is the minimum number of people required to be present during a confined space entry?
    (A) 3
    (B) 1
    (C) 2
    (D) 4

505.62M. If a 1-mgd plant has an chlorine demand of 4.5 mg/l and maintains a residual of 1.0 mg/l, what is the estimated required chlorine feed rate in pounds per day?
    (A) 46
    (B) 51
    (C) 68
    (D) 38

506.103M. Calculate the percent reduction in flows achieved by an industrial water conservation program if water flows are reduced from 350 gpm to 220 gpm
    (A) 31%
    (B) 44%
    (C) 63%
    (D) 59%
    (E) 37%

507.38MP. The total dynamic head against which a pump must operate:
    (A) Is the sum of the static head and the head due to friction loss.
    (B) Is the friction head.
    (C) Is the static head.
    (D) Must always be above the shutoff head.

508.L73. What is the maximum recommended holding time for a sample that is to be analyzed for pH?
    (A) None; it must be analyzed immediately
    (B) 48 hours
    (C) 14 days
    (D) 7 days

509.L29. Solids are classified by their _____ and whether they are organic or inorganic.

    _____

510.90MP. It is permitted to use a five-minute air escape capsule for entry or rescue in a confined space.
    (A) True
    (B) False

511.G37. Disaster planning is:
    (A) Having manuals ready so they can be read if a disaster occurs
    (B) Something that, if properly done, will not need to be revised
    (C) Useful in reducing confusion in the event of a disaster
    (D) None of the above

512.D46. If your 1 ton chlorine cylinder is leaking, what type of Chlorine Institute repair kit should be used?
    (A) B
    (B) C
    (C) D
    (D) A

513.76MP. A proper steel-toe safety shoe should be capable of resisting the impact of at least _____ft-lb
      (A) 300
      (B) 100
      (C) 10
      (D) 50

514.17C. Which one of the following chemicals would you most likely use as a coagulant?:
      (A) Hydrochloric acid
      (B) Sodium hydroxide
      (C) Sulfuric acid
      (D) Cationic polymer

515.16MP. An air gap device is used to:
      (A) Increase oxygen content in manholes
      (B) Prevent excessive vibration in pipe joints
      (C) Prevent cross connections
      (D) Ventilate manholes

516.1MP. The primary causes of motor failure are: Pick the two that apply.
      (A) Dirt
      (B) Moisture
      (C) Friction
      (D) Vibration and overload
      (E) All of these

517.6C. In conventional water treatment practices, the final step in the removal of suspended matter is:
      (A) Flocculation
      (B) Chlorination
      (C) Circulation
      (D) Filtration

518.15W. Select the best description of the function of a well sampling tap.
      (A) Permits sampling of pumped water.
      (B) Permits discharge of air in column pipe during start-up and admits air during shutdown.
      (C) Allows air to enter well during drawdown to prevent vacuum conditions. Vents excess air during well recovery period.
      (D) Provides watertight seal between the motor base and the concrete support pedestal.
      (E) Permits insertion of water level measuring device. Also used to add chlorine or well cleaning agents.
      (F) Supports the weight of the pumping unit.
      (G) Permits operator to see level of gravel and add gravel as necessary.
      (H) Permits measurement of water level by means of air pressure measurements.

519.29C. Tube settlers are used to:
      (A) Remove hardness
      (B) Reduce flow stability
      (C) Aid coagulation
      (D) Improve turbidity removal

520.2W. Porosity may be defined as
      (A) The ratio of filtered to reject water for a sand filter
      (B) The number of wells sunk per area into a particular aquifer
      (C) The percentage of open space or voids is a particular soil
      (D) None of these is correct

521.D41. Name the two forms of hypochlorite (in alphabetical order) used for disinfection:

_____

522.G40. Successful communication requires mutual:
      (A) Agreement
      (B) Transmission
      (C) Confusion
      (D) Understanding

523.L37. E. Coli results must always be higher or lower than fecal coliform results?
      (A) Lower
      (B) About the same
      (C) Higher

524.G94. The three basic types of water rights are (check all that apply)
     (A) Inherited
     (B) Well
     (C) Riparian
     (D) Draft
     (E) Grandfathered
     (F) Prescriptive
     (G) Appropriative

525.G51. 1 gallon = _____ liters
     (A) 7.48
     (B) 3.785
     (C) 8.34
     (D) 4.546
     (E) 2.08

526.41C. Iron and manganese may be removed from source waters by oxidation. The following chemicals are often used to precipitate iron. Check all that apply
     (A) Potassium permanganate
     (B) Sodium hydroxide
     (C) Alum
     (D) Chlorine

527.G46. List one type of common management plan.

_____

528.4W. Specific yield may be defined as:
     (A) The amount of water that a particular well produces when drained by gravity.
     (B) The amount of water that may be squeezed from a volume of rock or soil with a Vadose press.
     (C) The amount of water that a particular well produces when pumped forceably.
     (D) The amount of water that a particular volume of rock or soil will produce when drained by gravity.

529.33W. What is the purpose of surging?
     (A) To backwash filters rapidly.
     (B) To clean mineral deposits from well screens.
     (C) To remove blockages from the distribution system.
     (D) To prepare pump motors for erratic power supplies.

530.15MP. The pressure against which a pump must operate is measured in terms of:
     (A) head
     (B) ft-lb
     (C) psi
     (D) hp

531.R1. When are all water systems required to meet the new 10 ug/L standard for Arsenic?
     (A) January 23, 2006
     (B) December 31, 2004
     (C) 2010, the year we make contact
     (D) April 15, 2008

532.G36. The percent of oxygen in air at sea level is _____%
     (A) 21
     (B) 65
     (C) 33 1/3
     (D) 78

533.11MP. The elevation of any pump above the source of supply should not exceed _____ ft.
     (A) 224
     (B) 22
     (C) 200
     (D) 2.2

534.52M. What is the average flow velocity in ft/sec in a 12-in diameter force main carrying a daily flow of 2.5 mgd?
     (A) 4.9 ft/sec
     (B) 18.85 ft/sec
     (C) 5.3 ft/s
     (D) 18.0 ft/sec

535.2C. The main purpose of pre-sedimentation is to:
         (A) Increase alkalinity in the water
         (B) Reduce the silt in the water
         (C) Reduce the oxygen content in the water
         (D) Increase the oxygen content of water

536.L42. Alkalinity is titrated to the Bromo cresol green methyl red indicator endpoint which is
    equivalent to this pH.
         (A) 4.5
         (B) 3.0
         (C) 5.5
         (D) 6.5

537.50W. What might be the cause of of sand complaints from only one or two houses on a block?
         (A) Sand is entering the pipe near the residences through a leaky valve or break
         (B) Lateral is tapped into side of main near valve, creating turbulence
         (C) Lateral is tapped into top of main near valve, creating turbulence
         (D) Customers are imagining things

538.66MP. Material Safety Data Sheets (MSDS) must contain the following information:
         (A) Chemical name, manufacturer name, purchaser name, and disposal procedures
         (B) Chemical name, emergency procedures for spills, and necessary personal protective equipment
         (C) CAS number, concentration, manufacturer name and address, and possible uses
         (D) Purchaser name, acute and chronic health effects, and storage requirements

539.L7. _____ solids remain in liquid solution and are defined as the solids that will pass
    through a 0.45um membrane filter.
         (A) Colloidal
         (B) Dissolved
         (C) Suspended
         (D) Settleable

540.60M. The finished water chlorine demand is 12 mg/l, the target chlorine residual is 1.2 mg/l,
    and the plant flow is 5.6 MGD. How many lbs/day of 65% hypochlorite solution will be required?
         (A) 113 lbs/day
         (B) 514 lbds/day
         (C) 948 lbs/day
         (D) 776 lbs/day

541.91MP. An oxygen-enriched atmosphere contains more than 21% oxygen.
         (A) False
         (B) True

542.86M. Liquid alum delivered to a water treatment plant contains 642.3 milligrams of aluminum
    per milliliter of liquid solution. Jar tests indicate that the best alum dose is 9 mg/L.
    Determine the setting on the liquid alum feeder in millilters per minute when the plant flow
    is 3.2 mgd.
         (A) 105 mL/min
         (B) 72 mL/min
         (C) 90 mL/min
         (D) 118 mL/min
         (E) 80 mL/min

543.L31. Tracking data is only the first step in control charting. These need to be set next.
         (A) Deviation Limits
         (B) Control Limits
         (C) Corrective Actions
         (D) Deviation Requirements

544.6W. This physical property is what prevents salt and freshwater from mixing in an aquifer or
    underground basin.
         (A) Temperature
         (B) pH
         (C) Specific gravity
         (D) Van der waals forces

545.47W. The mineral content and water quality of a particular well is usually pretty consistent.
         (A) False
         (B) True

546.L13. _____ is defined as the number of equivalents of solute dissolved in one liter of solution.
   (A) Normality
   (B) Molarity
   (C) Acidity
   (D) Alkalinity

547.L32. Control limits are meaningless unless these are also in place.
   (A) Standard Deviations
   (B) Deviation Requirements
   (C) Corrective Actions
   (D) Control Limits

548.44W. If an existing well becomes contaminated and the well pump is left in place, how much chlorine residual will be needed in the well casing to ensure adequate disinfection?
   (A) 100 mg/L
   (B) 400 mg/L
   (C) 1000 mg/L
   (D) 200 mg/L

549.R17. What health effects are associated with exposure to arsenic? (Select all that apply)
   (A) Loss of fingernails
   (B) Brain cancer
   (C) Liver and prostate cancer
   (D) Skin cancer
   (E) Blotchy skin
   (F) Immunological problems

550.D11. All chlorine cylinders are required to contain at least one fusible metal safety device designed to melt at between ___ to___ degrees F.
   (A) 200-212
   (B) 158-165
   (C) 100-120
   (D) None of these

551.73MP. Immediate first aid for burns is to
   (A) Immerse in warm water
   (B) Bandage tightly
   (C) Flood with cold water
   (D) Cover liberally with a salve

552.18W. Artesian wells are defined as
   (A) Being located in an aquifer more than 200 feet deep
   (B) Belonging to my brother Arty Sian
   (C) This designation is just a clever marketing ploy as it applys to all wells
   (D) Having water under a pressure greater than atmospheric which causes the water to rise
   (E) Any well used to pump high quality drinking water

553.29F. In a filter operating at a 2gpm/sq ft filtration rate, how much should the backwash water expand the sand bed during a backwash operation?
   (A) 20 to 30 percent
   (B) 10 to 20 percent
   (C) 30 to 50 percent
   (D) 0 to 10 percent
   (E) 90 to 100 percent

554.5M. A flow of 1.55 cubic feet per second is how many gallons per minute?
   (A) 776 gpm
   (B) 696 gpm
   (C) 965 gpm
   (D) 11.6 gpm

555.L36. Select all of the qualities of an ideal indicator organism from the following list.
   (A) Directly associated with target or pathogenic organism.
   (B) Not ubiquitous.
   (C) Present in greater numbers.
   (D) Easy to analyze for.
   (E) More difficult to kill than target organism.
   (F) Pathogenic

556.32M. Two 50-ft diameter, 10-ft deep sedimentation basins operating in parallel handle a flow
    of 2 mgd. What is the detention time in hours (assume the basins have flat floors)?
        (A) 2.0 hrs
        (B) 7.0 hrs
        (C) 3.5 hrs
        (D) 6.7 hrs

557.L20. Control charts are used to help minimize process _____.

        _____

558.G54. What does cfs stand for?

        _____

559.G8. The correct amount of chemical used to remove turbidity is known as the:
        (A) Optimum range
        (B) None, I just made this up
        (C) Combination dosage
        (D) Coagulation range
        (E) Efficiency range

560.L49. Fecal coliforms are a subset of this larger group of bacteria.

        _____

561.61MP. A well pump will not shut down. Possible causes include:
        (A) Low line voltage
        (B) Defective timer in pump stop mode
        (C) Leaking foot valve
        (D) Fuses burned out
        (E) Defective pressure switch

562.39W. A shallow well pump is located higher in elevation than the well discharge.
        (A) False
        (B) True

563.66M. To accurately obtain a chlorine residual from your system you are sampling at a customer
    tap. You would like to flush twice the volume of the service line before sampling. The
    service line is 3/4" and approximately 200 feet from the main. How many gallons must you flush?
        (A) 0.61
        (B) 46
        (C) 610
        (D) 61
        (E) 4.6

564.80MP. In a confined space entry, the entry supervisor must ensure that all confined space
    entry permit provisions have been fulfilled and certify the same by signing the permit.
        (A) True
        (B) False

565.63MP. A well pump continues to trip its overload relays. The appropriate corrective action
    would be
        (A) Keep resetting the relays and restarting the pump.
        (B) Verify that thermal relay components are correctly sized.
        (C) Check the motor rotation.
        (D) Blame the engineer.

566.R15. What does CCR stand for?
        (A) Client Care Report
        (B) Customer Client Relations
        (C) Consumer Confidence Report
        (D) City Consumption Report

567.R19. Generally higher levels of arsenic tend to be found in surface waters compared to ground water.
        (A) True
        (B) False

568.69M. How many pounds of sodium hypochorite solution will be needed to provide 25 pounds of available chlorine if the sodium hypochlorite solution contains 8 percent available chlorine by weight?
    (A) 16.68 pounds
    (B) 27.0 pounds
    (C) 200 pounds
    (D) 312.5 pounds

569.L66. The range of a pH analyzer is
    (A) 1 to 14 pH units
    (B) 0 to 14 pH units
    (C) 2 to 14 pH units
    (D) 4 to 14 pH units

570.R18. Arsenic is a naturally occurring contaminant found in rocks, soil, air, and animals.
    (A) True
    (B) False

571.109M. Last month your Water System pumped 7,106,300 gallons of water into the distribution system. Your system was able to account for 5,264,800 gallons. What was your unaccounted for % of water for this month?
    (A) 88 %
    (B) 25.9 %
    (C) 47.1 %
    (D) 2.95 %
    (E) 74.1 %

572.G92. A cross connection is
    (A) Any connection between two pressure zones in a distribution system
    (B) A special type of t-connection for tapping into reservoirs and water tanks
    (C) A tool used for making wet-taps
    (D) Any connection between a drinking water system and an unapproved water supply

573.3C. Two fundamental treatment requirements for public water systems using surface water sources are:
    (A) Coagulation and sedimentation
    (B) Filtration and aeration
    (C) Disinfection and filtration
    (D) Lime softening and disinfection

574.D47. If your facility stores _____ or more of chlorine, you must develop a Risk Management Program in compliance with the USEPA's Chemical Accidental Release Prevention Regulations.
    (A) 1000 lb
    (B) 5000 lb
    (C) 500 lb
    (D) 2500 lb

575.L17. Quality control samples are analyzed for all of the following reasons EXCEPT:
    (A) Check for Contamination
    (B) Verify precision
    (C) Verify accuracy
    (D) Determine if interferences are present.
    (E) To boost the ego of the analyst.

576.28F. Treated water is always used for backwashing:
    (A) To avoid contamination of the filter bed
    (B) Because the use of untreated water is more costly
    (C) Lessen sludge disposal problems
    (D) Because of its availability

577.32F. The filter rate and backwash rate of each filter shall be determined and recorded:
    (A) Once each month
    (B) Once every six months
    (C) Once each week
    (D) Once each year
    (E) Once every three months

578.56M. A water treatment plant adds ferric chloride as a coagulant. The raw water enters the
plant at 10 mgd. Jar testing shows that the optimum ferric dose is 200 mg/L. If the ferric
chloride is delivered as a 47% solution, what should the chemical delivery pump rate be?
Express your answer in gpm.
    (A) 5.31
    (B) 2.96
    (C) 4255
    (D) 25.8

579.36MP. A _____ is installed on pump discharge piping to prevent water from flowing back across
a pump when it is off.
    (A) Smaller diameter of piping
    (B) Check valve
    (C) Backflow preventer
    (D) Butterfly valve

580.G100. Turbidimeters must be calibrated:
    (A) If factory calibrated, never
    (B) Quarterly
    (C) Weekly
    (D) Monthly
    (E) Daily

581.25W. If the operating pressure of a pressure relief valve is exceeding, what occurs?
    (A) The valve automatially opens to relieve pressure.
    (B) Nothing, this is where it normally operates. That is why we call it the operating pressure.
    (C) The valve will be damaged.
    (D) The valve automatically closes to prevent an unsafe condition downstream.

582.5C. Which treatment step is not used with direct filtration?:
    (A) Disinfection
    (B) Sedimentation
    (C) Coagulation
    (D) Flocculation

583.L61. Alkalinity is reported as:
    (A) Milliliters of sulfuric acid titrated
    (B) mg/l of calcium carbonate
    (C) Softness
    (D) Hardness

584.75MP. "Flammable" liquids have a flash point _____ 100 degrees F.
    (A) Below
    (B) Approximately equal to
    (C) What's a flash point?
    (D) Above

585.G16. Turbidity generally indicates the quantity of _____ material in a water,
particularly at low solids concentrations.
    (A) Dissolved
    (B) Colloidal
    (C) Dispersed
    (D) Settleable
    (E) Suspended

586.13C. The main purpose of coagulation/flocculation is to:
    (A) Disinfect water
    (B) Soften water
    (C) Add oxygen to water
    (D) Remove turbidity

587.13MP. Before repairing a pumps electrical circuit, which of the following actions should you take?
    (A) Turn the pump off
    (B) Tell all of the operators not to activate the circuit.
    (C) Disconnect the circuit breaker, place a red tag stating "do not activate", and lock out.
    (D) Notify your supervisor

588.L77. Before performing a membrane electrode DO test, the equipment should be calibrated to
zero by taking a reading on a sample containing an excess of _____ and a trace of cobalt
chloride, CoCl2.
- (A) Sodium hydroxide, NaOH
- (B) Calcium carbonate, CaCO3
- (C) Sodium sulfite, Na2SO3
- (D) Hydrogen chloride, HCl

589.R27. What are some of the health effects of short term exposure to lead?
- (A) Delays in physical and mental development in babies and children
- (B) There are no short term health effects
- (C) Causes kidney disease
- (D) Causes excessively brittle bones

590.24W. For well pump installations, the pressure relief valve operating pressure is usually
set at
- (A) 50 psi
- (B) 125 psi
- (C) 600 psi
- (D) 300 psi

591.7W. As groundwater moves through the soil, this type of material may be removed as the soil
behaves like a natural filter.
- (A) Suspended material
- (B) Dissolved material
- (C) Salts
- (D) Ammonia and other nitrogen compounds

592.33MP. During plant rounds, an operator notices a pump is spraying water from a packing gland.
The operator should
- (A) Tighten the packing gland until the spray is reduced to a small drip
- (B) Do nothing
- (C) Loosen the packing gland
- (D) Turn off the seal water and continue running the pump

593.16M. A pump delivering 288,000 gallons of water in 24 hours operates at what average flow rate?
- (A) 100 gpm
- (B) 1000 gpm
- (C) 12000 gpm
- (D) 200 gpm

594.57MP. What is an acceptable variation in input voltage for most electric motors?
- (A) +/- 5%
- (B) +/- 50%
- (C) +/- 20%
- (D) +/- 10%

595.D31. Which of the following is a correct set of characteristics for chlorine as used in disinfection?
- (A) Chlorine gas is colorless, flammable, and heavier than air
- (B) Chlorine gas is colorless, flammable, and lighter than air
- (C) Chlorine gas in greenish-yellow (amber) in color, toxic, lighter than air, and noncorrosive
- (D) Chlorine gas is greenish-yellow (amber) in color, flammable, and lighter than air
- (E) Chlorine gas is toxic, corrosive, and heavier than air

596.23C. The normal range of detention times used in sedimentation basins in conventional water
treatment plants is about:
- (A) 10 sec.
- (B) A day
- (C) 60 sec.
- (D) 3-6 hours

597.17W. Select the best description of the function of a well pump blow-off (or drain line).
- (A) Used to remove first water (usually sandy) pumped at start-up.
- (B) Supports the weight of the pumping unit.
- (C) Provides watertight seal between the motor base and the concrete support pedestal.
- (D) Permits operator to see level of gravel and add gravel as necessary.
- (E) Permits measurement of water level by means of air pressure measurements.
- (F) Permits sampling of pumped water.
- (G) Permits insertion of water level measuring device. Also used to add chlorine or well
  cleaning agents.
- (H) Permits discharge of air in column pipe during start-up and admits air during shutdown.

598.23M. The effluent weir of a clarifier is located along the rim of a 60-ft diameter tank.
What is the approximate length of the weir?
    (A) 188 feet
    (B) 540 feet
    (C) 2826 feet
    (D) 377 feet

599.R31. What are the EPA approved methods of treatment for the removal of nitrites/nitrates from
drinking water?
    (A) Slow Sand Filtration
    (B) EPA recommends source water protection methods only
    (C) Coagulation, Flocculation, and Sedimentation
    (D) Ion Exchange, Reverse Osmosis and Electrodialysis

600.68MP. CAS numbers identify
    (A) Hazard levels of chemicals
    (B) Reactivity levels of chemicals
    (C) Abstract chemical reactions
    (D) Specific chemical substances
    (E) Chemical analysis services

601.22W. Water hammer may be caused by
    (A) Filling a water storage tank too slowly
    (B) Quick opening or closing of a valve
    (C) Excessive air build-up in the distribution system
    (D) Undersized pipes in the distribution system

602.49W. This is the reason that pumps are primed prior to use
    (A) To avoid back-siphoning
    (B) To completely fill the pump cavity and displace any air
    (C) To prevent cross connections
    (D) To conserve water

603.G72. The difference in pressure between high- and low-pressure taps is proportional to the
square of the flow rate through the Venturi. Therefore, a differential-pressure sensor with
a square root output signal can be used to indicate flow.
    (A) False
    (B) True

604.R13. ppm and ppb stand for what, respectively?
    (A) Portions per month and portions per block
    (B) Portions per million and portions per billion
    (C) Parts per million and parts per billion
    (D) Parts per month and parts per block

605.12F. A rate-of-flow controller is commonly used in a water treatment plant:
    (A) On the outlet pipe of a rapid sand filter
    (B) To maintain a constant rate of flow of raw water to a rapid sand filter
    (C) Traffic into and out of the plant
    (D) To measure the rate of flow

606.D32. A chlorine leak can be detected by
    (A) Smell
    (B) Green or reddish deposits on metal
    (C) Waving an ammonia-soaked rag
    (D) All of these answers are correct
    (E) None of these answers are correct

607.36F. Repeated occurrence of a sand boil on the surface of a rapid sand filter at the same
location during back washing indicates which of the following?
    (A) A surface-wash system should be added
    (B) The supporting gravel bed underneath the filter sand has been disturbed
    (C) The filter's maximum backwash rate has been exceeded
    (D) The filter media is being properly fluidized during backwashing

608.77MP. An atmosphere should be considered dangerous when oxygen content falls below ___%
    (A) 25
    (B) 21
    (C) 20
    (D) 19

609.41MP. A centrifugal untreated raw water pump starts pumping at 25 gal/min and has a maximum pumping capacity of 100 gal/min. A Venturi flowmeter can be used to measure flow from this pump.
    (A) True
    (B) False

610.26MP. An electrical system for prevention of rust, corrosion, and pitting of steel and iron surfaces in contact with water is called _____ protection.
    (A) Cathodic
    (B) Sputterizing
    (C) Galvanic
    (D) Tempering

611.20M. The diameter of a clear well is 10 ft. If filled to a depth of 10 ft. It will contain approximate
    (A) 5872 gal.
    (B) 6024 gal.
    (C) 10,602 gal.
    (D) 2987 gal.

612.11C. Alum added to turbid water containing alkalinity forms _____, which increase in size and settle out.:
    (A) Floc particles
    (B) Aluminum sulfate
    (C) Coagulant aids
    (D) Coagulants

613.L76. What is the standard sample volume when measuring chlorine levels by an amperometric titration?
    (A) 100 ml
    (B) 150 ml
    (C) 200 ml
    (D) 50 ml

614.71MP. What does SCBA stand for?

_____

615.L51. This is the special sugar that fecal coliform bacteria can metabolize.
    (A) Fructose
    (B) Lactose
    (C) Rosalic acid
    (D) Glucose

616.23W. This may be used to control and/or eliminate water hammer.
    (A) Capacitor relays
    (B) Rapid opening of valves
    (C) Air vents
    (D) Pressure relief valve

617.84MP. For hearing protection, workers should wear either safety plugs or safety earmuffs, but never both simultaneously.
    (A) False
    (B) True

618.21W. Sounding tubes should generally have a minimum _____ inch diameter.
    (A) Two (2)
    (B) Six (6)
    (C) One-half (1/2)
    (D) Ten (10)

619.40F. A rapid sand filter is 12 ft wide and 20 ft long. If the flow through the filter is 0.83 mgd, what is the filter-loading rate in gpm/ft2?
    (A) 2.4 gpm/ft2
    (B) 24 gpm/ft2
    (C) 4.8 gpm/ft2
    (D) 48 gpm/ft2

Small_Water_System_10-19-07

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Answer Key

1. D

2. A

3. C

4. C

5. B

6. D

7. D

8. D

9. C, D, E

10. B

11. D

12. B, C, D

13. A

14. A

15. A

16. B

17. C

18. A

19. C

20. C

21. D

22. C

23. B

24. A

25. B

26. C

27. Blanks, Blank, Reagent Blank, Instrument Blank

28. B

29. E

30. C

31. A

32. C

33. E

34. E

35. C

36. C

37. D

38. A

39. A

40. C

41. Contamination

42. A, D

43. A

44. D

45. D

46. D

47. A

48. C

49. D

50. C

51. A

52. D

53. D

54. A

55. D

56. B

57. D

58. feed rate, pounds per day, lb/day, dose, ppd

59. chain custody, chain of custody, chain, custody

60. B

61. D

62. A

63. D

64. C

65. A

66. B

67. B

68. D

69. D

70. D

71. A

72. B

73. B

74. D

75. C

76. B

77. B

78. B

79. B

80. E

81. C

82. B

83. E

84. B

85. A

86. C

87. C

88. Calcium Carbonate – mg/L, Calcium carbonate, Calcium carbonate, mg/L, mg/L Calcium carbonate, CaCO3

89. B

90. B

91. C

92. B

93. A

94. A

95. C

96. A

97. C

98. A

99. C

100. B

101. B

102. B

103. Negatives and Positives, Positives and Negatives, Negatives, Positives, Positives, Negatives

104. B

105. D

106. E

107. D

108. A

109. A, E

110. D

111. A

112. D

113. B

114. F

115. A

116. B

117. C

118. E

119. D

120. Zero, 0, None

121. E

122. D

123. B

124. C

125. C

126. E

127. C

128. A

129. C

130. B

131. B

132. A

133. A

134. B

135. A

136. D

137. B

138. C

139. C

140. C

141. A

142. A

143. A, B, D, E

144. B

145. B

146. B

147. B

148. E

149. A, D

150. C

151. D

152. A

153. A

154. B

155. B

156. A

157. A

158. C

159. A

160. C

161. A

162. B

163. B

164. A

165. A

166. D

167. A

168. A

169. B

170. C

171. D

172. A

173. A

174. C

175. A

176. B

177. C

178. C

179. B

180. A

181. C

182. B

183. C

184. B

185. D

186. A

187. B

188. B

189. C

190. B

191. B

192. D

193. A

194. B

195. B

196. D

197. A

198. D

199. B

200. D

201. B

202. B

203. A

204. B

205. D

206. D

207. A

208. D

209. B

210. D

211. D

212. D

213. A

214. B

215. Sequence = B, F, C, G, D, E, A

216. B

217. most probable number, MPN

218. B

219. C, D

220. B

221. B

222. C

223. E

224. A

225. C

226. B

227. C

228. B

229. A, B, C

230. D

231. B

232. E

233. A

234. C

235. A

236. Phase

237. D

238. C

239. C

240. Dimensional Analysis

241. A

242. B

243. B

244. C

245. A

246. A

247. A

248. E

249. B

250. C

251. A

252. D

253. D

254. D

255. C, F

256. B

257. A

258. A

259. D

260. A

261. D

262. B

263. B

264. B

265. B

266. B

267. B

268. A

269. A

270. B

271. C

272. D

273. D

274. B

275. A

276. D

277. B

278. A

279. A

280. C

281. C

282. C

283. D

284. C

285. A

286. E

287. A

288. Grab

289. A

290. C

291. C

292. B

293. B

294. C

295. B

296. B

297. F

298. D

299. E

300. A

301. B

302. D

303. A

304. A

305. C

306. D

307. D

308. A

309. B

310. C

311. A

312. E

313. C

314. C

315. A

316. E

317. A

318. B

319. D

320. C

321. C

322. D

323. C

324. C

325. E

326. A

327. D

328. C

329. B

330. A

331. A

332. E

333. B

334. A

335. C

336. C

337. B

338. C

339. C

340. B

341. A, B, C

342. B

343. A, B, F, G

344. B

345. A

346. B

347. C

348. C

349. Grab and Composite, Composite and Grab, Grab, Composite, Composite, Grab, Grab Composite, Composite Grab

350. C

351. D

352. C

353. C

354. D

355. A

356. C

357. B

358. D

359. A

360. C

361. B

362. D

363. C

364. B

365. B

366. C

367. B, C, D, F

368. B

369. A

370. A

371. D

372. B

373. B

374. C

375. A

376. B

377. B

378. A, B, D, F

379. C

380. D

381. chlorine dosage, dose, cl2 dose, chlorine dose

382. D

383. A

384. A

385. C

386. C

387. D

388. B

389. A

390. D

391. C

392. B

393. B

394. B

395. Sequence = D, C, B, A, E

396. B

397. A

398. B

399. C

400. A

401. A

402. A

403. E

404. C

405. E

406. A

407. Head

408. Flash mixer

409. D

410. B

411. D

412. A

413. D

414. D

415. Contamination

416. D

417. C

418. D

419. B

420. D

421. B, C, D

422. B

423. C

424. E

425. sand filter

426. A

427. B

428. B

429. A

430. C

431. B

432. D

433. C

434. C

435. A

436. B

437. B

438. C

439. A

440. C

441. B

442. C

443. B

444. B

445. D

446. F

447. C

448. D

449. C

450. B

451. Trends

452. A

453. B

454. D

455. D

456. C

457. A

458. A

459. C

460. Buffering, Acid Neutralizing

461. C

462. D

463. A

464. A, D

465. A

466. B

467. C

468. A

469. C

470. A

471. A

472. combined

473. B

474. E

475. A

476. B

477. D

478. A

479. C

480. B

481. B

482. A

483. Color

484. jar test

485. C

486. C

487. A

488. C

489. A

490. C

491. A

492. D

493. C

494. D

495. E

496. A

497. C

498. C

499. D

500. B

501. C

502. C

503. D

504. B

505. A

506. E

507. A

508. A

509. Size

510. B

511. C

512. A

513. A

514. D

515. C

516. B, D

517. D

518. A

519. D

520. C

521. Calcium hypochlorite, Sodium hypochlorite, Calcium hypochlorite and Sodium hypochlorite, Calcium and Sodium, Calcium, Sodium, Ca, Na

522. D

523. A

524. C, F, G

525. B

526. A, D

527. Strategic, Contingency, Single use, Program, Capital facility, Financial

528. D

529. B

530. C

531. A

532. A

533. B

534. A

535. B

536. A

537. B

538. B

539. B

540. C

541. A

542. D

543. B

544. C

545. B

546. A

547. C

548. D

549. C, D, F

550. B

551. C

552. D

553. A

554. B

555. A, B, C, D, E

556. C

557. Variability

558. cubic feet per second, cubic feet/second, cubic ft/sec, ft3/sec, cuft/sec

559. A

560. Total Coliforms, Enterics

561. B, E

562. B

563. E

564. A

565. B

566. C

567. B

568. D

569. B

570. A

571. B

572. D

573. C

574. D

575. E

576. A

577. C

578. B

579. B

580. B

581. A

582. B

583. B

584. A

585. E

586. D

587. C

588. C

589. A

590. B

591. A

592. A

593. D

594. D

595. E

596. D

597. A

598. A

599. D

600. D

601. B

602. B

603. B

604. C

605. B

606. D

607. B

608. D

609. A

610. A

611. A

612. A

613. C

614. self contained breathing apparatus

615. B

616. D

617. A

618. A

619. A