1. The operating budget for the year was $94,571. At the end of 10 months $17,863 remained. How much had been expended?
   a. $67,708
   b. $67,807
   c. $76,708
   d. $87,706

2. Cavitation is a problem with pumps. What can be done to prevent it from occurring?
   a. clear the blow-off valve
   b. place another pump on the line
   c. reduce the suction head
   d. reduce the suction lift

3. The least head loss in a pipeline would be caused by a fully open
   a. angle valve.
   b. check valve.
   c. gate valve.
   d. globe valve.

4. In a conventional treatment plant using pH adjustment, the minimum number of runs in a jar test is
   a. one.
   b. two.
   c. three.
   d. four.

5. To convert milligrams per litre to grains per gallons, multiply milligrams per litre by
   a. 98.6.
   b. 62.4.
   c. 17.1.
   d. 8.34.

6. Tastes and odors from phenolic compounds may be _____ by chlorination.
   a. decreased
   b. increased
   c. removed

7. Calcium oxide is also called
   a. slaked lime.
   b. quicklime.
   c. hydrated lime.
   d. dehydrated lime.
8. If a water tank is filled with water to a height of 40 ft and the tank is 20 ft in diameter, the pressure at the base of the tank is _____ psi.
   a. 17.32
   b. 62.4
   c. 144
   d. 1440

9. From a sanitary standpoint, the pressure in a distribution system should not be allowed to fall to zero because
   a. the chlorine residual will escape.
   b. low pressure allows bacteria to multiply.
   c. groundwater may enter and backsiphonage may occur.
   d. none of the above.

10. Which one of the following is a hazard when using hydrofluosilicic acid?
    a. corrosiveness
    b. explosiveness
    c. flammability
    d. none of the above

11. Static suction head plus friction suction head plus static discharge head plus friction discharge head makes up the ___________ of a pump.
    a. operating pressure
    b. pump curve
    c. total dynamic head
    d. velocity head

12. The volume of a cone with a radius of 8 ft and a height of 12 ft is ________ft³.
    a. 84
    b. 256
    c. 502
    d. 804

13. Water is at its greatest density at a temperature of
    a. 32°F (0°C).
    b. 39.2°F (4°C).
    c. 37°F (3°C).
    d. 45°F (7°C).

14. A heavy growth of algae in a surface water reservoir will have which one of the following effects on the water?
    a. lower the pH
    b. raise the pH
    c. will have no effect on the pH

15. A step in determining the threshold odor number is
    a. counting the odor-producing organisms present.
    b. diluting the sample with distilled water.
    c. diluting the sample with odor-free water.
    d. matching the odor against the standards.
16. A centrifugal pump when operating normally shows a discharge pressure of 100 psi and the Venturi meter shows a flow rate of 20,000 gpm. Suddenly the pressure drops to 90 psi and the flow rate increases to 23,000 gpm. You would suspect  
   a. a faulty gauge and manometer tube.  
   b. a large leak in the pump discharge line.  
   c. foreign matter caught in the Venturi-tube throat.  
   d. the packing is sucking air.  
17. A test on a water supply showed a hardness of 232 mg/L. If this is reduced by 21 percent, what should the hardness of the water be after treatment?  
   a. 138 mg/L  
   b. 174 mg/L  
   c. 183 mg/L  
   d. 211 mg/L  
18. A water treatment plant used 647 chlorine cylinders during one year's operation. The average withdrawal from each cylinder was 138 lb. What was the total number of pounds of chlorine used?  
   a. 89,875 lb  
   b. 89,286 lb  
   c. 70,872 lb  
   d. 69,876 lb  
19. The bacteriocidal action of free available chlorine compared with that of combined available chlorine is  
   a. greater.  
   b. less.  
   c. the same under most conditions.  
   d. not possible to determine.  
20. The condition in infants known as methemoglobinemia is thought to be caused mainly by high concentrations of  
   a. phosphate.  
   b. nitrate.  
   c. fluoride.  
   d. chloride.  
21. The flow through a water treatment plant is 27,777 gpm. The flow is _____mgd.  
   a. 0.27  
   b. 14  
   c. 27  
   d. 40  
22. Vertical turbine pumps that are used in wells may be oil lubricated or water lubricated. Operators should use extreme care not to start any water-lubricated pump before making sure that the  
   a. bearings are dry.  
   b. bearings are wet.  
   c. valve on the discharge side is closed.  
   d. valve on the suction side is closed.
23. The chemical symbol for potassium is
   a. Al.
   b. Ba.
   c. K.
   d. Po.

24. Concentrations of hardness are expressed in terms of
   a. a percent of calcium hardness to total hardness.
   b. calcium and magnesium hardness.
   c. milligrams per litre as CaCO₃.
   d. soft to very hard.

25. The amperometric titration method is used to measure
   a. alkalinity.
   b. chlorine residual.
   c. pH.
   d. total hardness.

26. Mark the correct number of coliform per 100 mL when a membrane filter count
    shows 43 coliform colonies and 1.00 mL of sample was filtered.
    a. 430
    b. 4300
    c. 43,000
    d. 430,000

27. Nonsettleable solids are classified as __________ solids.
   a. suspended, colloidal, and dissolved
   b. colloidal, dissolved, and total dissolved
   c. colloidal, bacterial, and suspended
   d. coarse, fine, and very fine

28. Your pump broke down, your storage tank contained 1 mil gal, and water was being
    withdrawn at a rate of 0.5 mgd, how long woud it take for the tank to empty?
    a. 1 day
    b. 2 days
    c. 3 days
    d. 4 days

29. The chemical formula for copper sulfate is
   a. CaCO.
   b. CaCO₃.
   c. CuSO₄·5H₂O.
   d. H₂SO₄.

30. A Venturi tube increases the velocity and decreases the pressure as water flows
    through it. This type of tube is used to
    a. aerate the water.
    b. measure the amount of chlorine in the water.
    c. measure the amount of suspended solids in the water.
    d. measure the rate of water flowing through it.
31. The amount of chlorine actually used can best be determined by  
a. calculating the chlorine demand. 
b. converting the dosage rate at 8-h intervals to pounds used. 
c. the WAG method. 
d. use of scales.

32. The most hazardous condition associated with storage areas, slurry tanks, or other confined spaces where wet activated carbon is present is  
a. combustion. 
b. depletion of oxygen. 
c. fire. 
d. oxidation.

33. Two tests used to monitor the disinfection process are  
a. chlorine demand and chlorine residual tests. 
b. chlorine residual and bacteriological tests. 
c. membrane filter and multiple-tube tests. 
d. standard plate count and chlorine demand test.

34. A calm area within a settling basin necessary for suspended materials to settle is the _______ zone.  
a. inlet 
b. outlet 
c. settling 
d. sludge

35. The water treatment chemical copperas is  
a. aluminum sulfate. 
b. chlorinated lime. 
c. copper sulfate. 
d. iron sulfate.

36. As long as free chlorine and organic precursors are available, the total trihalomethane (TTHM) production will most probably  
a. continue to fall. 
b. continue to rise. 
c. fall and then rise. 
d. stay the same.

37. The free chlorine residual in water is measured as the amount of  
a. chloride in water. 
b. chlorine applied as measured in milligrams per litre. 
c. chlorine in raw water as comes from the stream, reservoir, or well. 
d. uncombined chlorine that remains in the water after the chlorine has been applied and allowed to react.
38. Chlorine use at a water treatment plant averages 81 lb/d. Assuming that the average daily flow is 13 mgd, the dosage rate is ________ mg/L.
   a. 0.5
   b. 0.75
   c. 1.0
   d. 715

39. The chemical formula for calcium carbonate is
   a. CaCO₃.
   b. CuSO₄.
   c. NaCl.
   d. NaCO.

40. The chemical formula for alum is
   a. AlSO₃.
   b. Al(CaCO₃).
   c. Al₂(SO₄)₃ . 14 H₂O.
   d. Fe(SO₄)₃.

41. If a valve in a pipeline is closed too rapidly it will cause the water in that pipeline to come to a sudden stop, causing waves of high pressure that oscillate back and forth in the pipeline. This reaction is commonly known as
   a. hydraulic gradient.
   b. pipeline dynamics.
   c. static oscillation.
   d. water hammer.

42. Eight boxes of packing (for pumps) were delivered, and the invoice showed $15.93 each. What is the total cost of packing?
   a. $106.34
   b. $109.31
   c. $111.51
   d. $127.44

43. A cylindrical tank with a radius of 5 ft is filled to a depth of 10 ft with water. Approximately how many gallons of water does it contain?
   a. 578 gal
   b. 785 gal
   c. 870 gal
   d. 5870 gal

44. One of the most common causes of errors in water quality analysis is
   a. contaminated reagents.
   b. improper sampling.
   c. poor laboratory equipment.
   d. poorly trained analysts.
45. One of the problems with ductile-iron pipe is
   a. cutting the pipe.
   b. pipe flexibility.
   c. lack of being malleable.
   d. limitation on pressure.

46. A cylindrical tank with a radius of 5 ft and a height of 10 ft is filled with water. If 3 lb of a chemical is dissolved in the water, what is the dosage?
   a. 112 mg/L
   b. 75 mg/L
   c. 61 mg/L
   d. 27 mg/L

47. Centrifugal pump noises will most likely be due to
   a. cavitation.
   b. excessive head pressure.
   c. high velocity.
   d. sand.

48. To facilitate check-valve repairs, a gate valve should be placed
   a. between the pump and the check valve.
   b. in parallel to the check valve.
   c. on the discharge side of the check valve.
   d. on the suction side of the pump.

49. The invert elevation of a pipe refers to the elevation of the center
   a. line of the pipe.
   b. of the bottom on the inside.
   c. of the bottom on the outside.
   d. of the top on the inside.

50. The term "clarification" is most closely related to
   a. all in-plant treatment processes.
   b. purification.
   c. sedimentation.
   d. the coagulation and flocculation processes.

51. Five grains per gallon is ______ mg/L.
   a. 35
   b. 58
   c. 86
   d. 506

52. Hydrogen sulfide in well water will cause the water to have an odor similar to
   a. ammonia.
   b. chlorine gas.
   c. rotten eggs.
   d. fish eggs.
53. Which laboratory test in a water plant is concerned with indicator changes at pH 8.3 and about pH 4.5?  
   a. total hardness  
   b. total chlorine residual  
   c. pH  
   d. alkalinity

54. Which one of the following types of pumps works on the basis of inertia or mass moving in a circular motion?  
   a. air lift  
   b. centrifugal  
   c. diaphragm  
   d. gear

55. The purpose of the jar test is to determine the  
   a. amount of chlorine to add for breakpoint chlorination.  
   b. correct amount of coagulant to use for proper coagulation.  
   c. length of the flash mix.  
   d. proper amount of mixing and settling time to remove turbidity.

56. The indicator methyl orange is used in the test for  
   a. alkalinity.  
   b. chlorine residual.  
   c. pH.  
   d. total hardness.

57. Hardness in water is caused mainly by the presence of  
   a. calcium and magnesium compounds.  
   b. iron and manganese compounds.  
   c. lime and soda ash.  
   d. turbidity and suspended solids.

58. Water that is high in sulfate can cause  
   a. diarrhea.  
   b. hardening of the arteries.  
   c. mottling of tooth enamel.  
   d. staining of plumbing fixtures.

59. The effluent weir of a clarifier is located along the rim of a 60-ft-diameter tank. The length of the weir is ______ ft.  
   a. 188  
   b. 201  
   c. 248  
   d. 300

60. A number of grab sample test results that are averaged together constitute  
   a. a composite test result.  
   b. a poor analytical procedure.  
   c. an average concentration.  
   d. grounds for violating state or federal regulations.
61. The term aeration is defined as bringing water into intimate contact with
   a. air.
   b. carbon dioxide.
   c. hydrogen sulfide.
   d. methane.

62. Which of the following types of pumps works on the principle of a decrease in the
    overall specific weight of a confined column of a gas-water mixture?
   a. air lift
   b. centrifugal
   c. diaphragm
   d. piston

63. A tank holding 2340 gal fills in 12 min. The rate of flow is ______ gpm.
   a. 195
   b. 234
   c. 284
   d. 382

64. The chlorine room should be constructed so it can be entered only from the
   a. inside of the building.
   b. laboratory.
   c. outside and inside of the building.
   d. outside of the building.

65. A rectangular ground storage tank is 60-ft wide, 120-ft long, and 12-ft deep. The tank holds ______ gal.
   a. 86,400
   b. 646,272
   c. 720,576
   d. 800,000

66. Destruction of harmful bacteria by chlorine is directly related to
   a. contact time and chlorine concentration.
   b. efficient chlorine dosage levels.
   c. whether or not breakpoint chlorination is practiced.
   d. whether prechlorination is practiced.

67. What type of treatment should be given when a well produces red water?
   a. fluoride removal
   b. taste and odor control
   c. sedimentation
   d. pH adjustment, aeration, and filtration

68. The chemical that is most commonly added to reservoirs for the control of algae is
   a. aluminum sulfate.
   b. calcium hypochlorite.
   c. copper sulfate.
   d. sodium chloride.
69. The standard sample for the multiple-tube fermentation method of testing for coliform bacteria consists of ______ portions.
   a. ten 5-mL
   b. two 10-mL
   c. five 10-mL
   d. ten 10-mL

70. Recent studies on prechlorination practices point out that the interaction of chlorine with organic matter in raw water forms
   a. carcinogens.
   b. lysergic acid.
   c. other odor-related compounds.
   d. trihalomethanes.

71. A new water treatment facility for a small town is estimated to cost $1,493,472. What is the average cost per person if 1986 people live in the town?
   a. $5720
   b. $2750
   c. $752
   d. $572

72. The purpose in practicing breakpoint chlorination is to
   a. eliminate taste and odor.
   b. increase the contact time needed to kill disease-causing organisms.
   c. produce a free chlorine residual, which is an effective disinfectant.
   d. reduce chlorine demand.

73. Bacterial pollution moving underground in shattered limestone
   a. will be removed in 10 ft.
   b. will be removed in 100 ft.
   c. will be removed in less than 1 mi.
   d. may never be removed.

74. How many milligrams per litre of chlorine will be added when 10 lb. of chlorine gas is added to 333,000 gal of water?
   a. 8.34 mg/L
   b. 4.17 mg/L
   c. 3.6 mg/L
   d. 0.5 mg/L

75. The total dynamic head against which a pump must operate
   a. is the friction head.
   b. is the static head.
   c. is the sum of the static head and the head due to friction loss.
   d. must always be above the shutoff head.

76. A centrifugal-type pump should never be run empty except momentarily because
   a. a serious counterpressure would be built up by excessive vacuum.
   b. it is useless to run a pump without getting water.
   c. the excessive end thrust of the shaft would damage the thrust bearing.
   d. the parts lubricated by water would be damaged.
77. When a centrifugal pump with new packing is started and the packing seems to leak air, the proper procedure is to
   a. stop the motor and repack the stuffing box.
   b. put in some heavy oil and then gradually tighten the gland.
   c. put in more packing.
   d. ignore the condition.

78. Optimum coagulant dosage can be established by
   a. observing the pilot filter.
   b. performing jar tests.
   c. performing total solids tests.
   d. the breakpoint of chlorination.

79. Which word best describes "the chemical combination of substances in solution so as to cause separation in the insoluble form"?
   a. stabilization
   b. saturation
   c. precipitation
   d. coagulation

80. If the flow through a water treatment plant is 300,000 gpd and a dosage of 2 mg/L of chemical is applied, how many pounds of chemical will be used in 30 days?
   a. 100 lb
   b. 150 lb
   c. 175 lb
   d. 200 lb

81. Corrosive waters can be the result of the presence of
   a. acids.
   b. calcium.
   c. magnesium.
   d. organic material.

82. A substance added to water to promote the formation of a protective film in transmission pipes is known as
   a. a pacifier.
   b. a passivator.
   c. an inhibitor.
   d. cathodic protection.

83. How many pounds of a chemical must be added to 50,000 gal of water to produce a dosage of 75 mg/L?
   a. 15 lb
   b. 31 lb
   c. 60 lb
   d. 150 lb
84. The volume of water contained in a storage tank 14 ft in diameter and 20-ft deep is approximately ______ ft³.
   a. 900
   b. 2000
   c. 3100
   d. 4200

85. Bluestone is a
   a. common name for copper sulfate.
   b. mineral in water that causes blue stains.
   c. mineral not dissolvable in water.
   d. stone for sharpening chisels.

86. The outlet of a forced ventilation system for a chlorinator room should be located
   a. above the window.
   b. near the floor.
   c. on the roof.
   d. 6 ft above the floor.

87. Water leaking to the surface after operating an old valve probably is caused by
   a. a broken stem.
   b. dried out packing.
   c. plugged weep holes.
   d. none of the above.

88. Pathogens are best described as
   a. an acute case of indigestion.
   b. an indicator test for viruses.
   c. cancer-producing agents.
   d. disease-causing organisms.

89. How are valves checked to determine that they are holding properly?
   a. by compressed air
   b. by electrostatic test
   c. by a pressure test
   d. by a torque wrench

90. Activated carbon is used to reduce
   a. alkalinity.
   b. hardness.
   c. pH.
   d. tastes and odors.

91. How many gallons does 1000 ft of 15-inc.-diameter pipe contain?
   a. 64 gal
   b. 1227 gal
   c. 2295 gal
   d. 9179 gal
92. When hard water is softened by the zeolite ion-exchange process, which substance is exchanged for calcium and magnesium and will appear in the product water?
   a. chloride
   b. nitrate
   c. sodium
   d. sulfate

93. A chemical commonly used for coagulation in water treatment is
   a. alum.
   b. chlorine.
   c. copper sulfate.
   d. soda ash.

94. The disinfection process kills
   a. all bacteria.
   b. only protozoans.
   c. pathogenic bacteria.
   d. all algae.

95. By continuously withdrawing chlorine, how many pounds per day can be withdrawn safely from a 150-lb cylinder at room temperature without the line freezing?
   a. 10 lb/d
   b. 40 lb/d
   c. 70 lb/d
   d. 100 lb/d

96. A rectangular tank measures 80-ft long, 30-ft wide, and 20-ft deep. If 100,000 gal of water is pumped into the tank, how high will the level of the tank rise?
   a. 2.5 ft
   b. 5.6 ft
   c. 25.5 ft
   d. 55.5 ft

97. What is the amount of chlorine required to treat 5 mgd to provide a 0.8-mg/L residual and satisfy 2.4-mg/L chlorine demand?
   a. 33.33 lb
   b. 66.67 lb
   c. 100.00 lb
   d. 133.33 lb

98. What is the detention time in a storage tank 20-ft high and 30 ft in diameter, when the rate of flow is 500,000 gpd?
   a. 2 h 10 min
   b. 3 h 48 min
   c. 4 h 27 min
   d. 5 h 4 min
99. If pressure at the water main is 60 psi, what is the static pressure on the plumbing faucet 40-ft above the main?
   a. 40 psi
   b. 42.7 psi
   c. 62.7 psi
   d. 97.3 psi

100. Discharge valves on ton containers should be positioned
   a. according to the green arrows painted on the end of the containers.
   b. horizontally opposite the other.
   c. one above the other.
   d. randomly, to simplify connection procedures.
Answers
Water Treatment
Class II

1. c  26. b  51. c  76. d  100. c.
2. d  27. a  52. c  77. a.
3. c  28. b  53. d  78. b.
4. a  29. c  54. b  79. c.
5. c  30. d  55. b  80. b.
6. b  31. d  56. a  81. a.
7. b  32. b  57. a  82. c.
8. a  33. b  58. a  83. b.
9. c  34. c  59. a  84. c.
10. a 35. d  60. c  85. a.
11. c  36. b  61. a  86. b.
12. d  37. d  62. a  87. b.
13. b  38. b  63. a  88. d.
14. b  39. a  64. d  89. c.
15. c  40. c  65. b  90. d.
16. b  41. d  66. a  91. d.
17. c  42. d  67. d  92. c.
18. b  43. d  68. c  93. a.
19. a  44. b  69. c  94. c.
20. b  45. a  70. d  95. b.
21. d  46. c  71. c  96. b.
22. b  47. a  72. c  97. d.
23. c  48. c  73. d  98. d.
24. c  49. b  74. c  99. b.