

Water Treatment Study Guide

Class II (Made available by: Kansas Rural Water Association)

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.
- 17.32
 - 62.4
 - 144
 - 1440
9. From a sanitary standpoint, the pressure in a distribution system should not be allowed to fall to zero because
- the chlorine residual will escape.
 - low pressure allows bacteria to multiply.
 - groundwater may enter and backsiphonage may occur.
 - none of the above.
10. Which one of the following is a hazard when using hydrofluosilicic acid?
- corrosiveness
 - explosiveness
 - flammability
 - 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.
- operating pressure
 - pump curve
 - total dynamic head
 - velocity head
12. The volume of a cone with a radius of 8 ft and a height of 12 ft is _____ ft³.
- 84
 - 256
 - 502
 - 804
13. Water is at its greatest density at a temperature of
- 32°F (0° C).
 - 39.2°F (4° C).
 - 37°F (3° C).
 - 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?
- lower the pH
 - raise the pH
 - will have no effect on the pH
15. A step in determining the threshold odor number is
- counting the odor-producing organisms present.
 - diluting the sample with distilled water.
 - diluting the sample with odor-free water.
 - 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 faulty gauge and manometer tube.
 - a large leak in the pump discharge line.
 - foreign matter caught in the Venturi-tube throat.
 - 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?
- 138 mg/L
 - 174 mg/L
 - 183 mg/L
 - 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?
- 89,875 lb
 - 89,286 lb
 - 70,872 lb
 - 69,876 lb
19. The bacteriocidal action of free available chlorine compared with that of combined available chlorine is
- greater.
 - less.
 - the same under most conditions.
 - not possible to determine.
20. The condition in infants known as methamoglobinemia is thought to be caused mainly by high concentrations of
- phosphate.
 - nitrate.
 - fluoride.
 - chloride.
21. The flow through a water treatment plant is 27,777 gpm. The flow is _____ mgd.
- 0.27
 - 14
 - 27
 - 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
- bearings are dry.
 - bearings are wet.
 - valve on the discharge side is closed.
 - valve on the suction side is closed.

23. The chemical symbol for potassium is
- Al.
 - Ba.
 - K
 - Po.
24. Concentrations of hardness are expressed in terms of
- a percent of calcium hardness to total hardness.
 - calcium and magnesium hardness.
 - milligrams per litre as CaCO_3 .
 - soft to very hard.
25. The amperometric titration method is used to measure
- alkalinity.
 - chlorine residual.
 - pH.
 - 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.
- 430
 - 4300
 - 43,000
 - 430,000
27. Nonsettleable solids are classified as _____ solids.
- suspended, colloidal, and dissolved
 - colloidal, dissolved, and total dissolved
 - colloidal, bacterial, and suspended
 - 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 would it take for the tank to empty?
- 1 day
 - 2 days
 - 3 days
 - 4 days
29. The chemical formula for copper sulfate is
- CaCO .
 - CaCO_3 .
 - $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.
 - H_2SO_4 .
30. A Venturi tube increases the velocity and decreases the pressure as water flows through it. This type of tube is used to
- aerate the water.
 - measure the amount of chlorine in the water.
 - measure the amount of suspended solids in the water.
 - measure the rate of water flowing through it.

31. The amount of chlorine actually used can best be determined by
- calculating the chlorine demand.
 - converting the dosage rate at 8-h intervals to pounds used.
 - the WAG method.
 - 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
- combustion.
 - depletion of oxygen.
 - fire.
 - oxidation.
33. Two tests used to monitor the disinfection process are
- chlorine demand and chlorine residual tests.
 - chlorine residual and bacteriological tests.
 - membrane filter and multiple-tube tests.
 - standard plate count and chlorine demand test.
34. A calm area within a settling basin necessary for suspended materials to settle is the _____ zone.
- inlet
 - outlet
 - settling
 - sludge
35. The water treatment chemical copperas is
- aluminum sulfate.
 - chlorinated lime.
 - copper sulfate.
 - iron sulfate.
36. As long as free chlorine and organic precursors are available, the total trihalomethane (TTHM) production will most probably
- continue to fall.
 - continue to rise.
 - fall and then rise.
 - stay the same.
37. The free chlorine residual in water is measured as the amount of
- chloride in water.
 - chlorine applied as measured in milligrams per litre.
 - chlorine in raw water as comes from the stream, reservoir, or well.
 - 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.
- 0.5
 - 0.75
 - 1.0
 - 715
39. The chemical formula for calcium carbonate is
- CaCO_3 .
 - CuSO_4 .
 - NaCl .
 - NaCO .
40. The chemical formula for alum is
- ALSO.
 - $\text{Al}(\text{CaCO}_3)$.
 - $\text{Al}_2(\text{SO}_4)_3 \cdot 14 \text{H}_2\text{O}$.
 - $\text{Fe}(\text{SO}_4)_3$.
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
- hydraulic gradient.
 - pipeline dynamics.
 - static oscillation.
 - 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?
- \$106.34
 - \$109.31
 - \$111.51
 - \$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?
- 578 gal
 - 785 gal
 - 870 gal
 - 5870 gal
44. One of the most common causes of errors in water quality analysis is
- contaminated reagents.
 - improper sampling.
 - poor laboratory equipment.
 - poorly trained analysts.

45. One of the problems with ductile-iron pipe is
- cutting the pipe.
 - pipe flexibility.
 - lack of being malleable.
 - 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?
- 112 mg/L
 - 75 mg/L
 - 61 mg/L
 - 27 mg/L
47. Centrifugal pump noises will most likely be due to
- cavitation.
 - excessive head pressure.
 - high velocity.
 - sand.
48. To facilitate check-valve repairs, a gate valve should be placed
- between the pump and the check valve.
 - in parallel to the check valve.
 - on the discharge side of the check valve.
 - on the suction side of the pump.
49. The invert elevation of a pipe refers to the elevation of the center
- line of the pipe.
 - of the bottom on the inside.
 - of the bottom on the outside.
 - of the top on the inside.
50. The term "clarification" is most closely related to
- all in-plant treatment processes.
 - purification.
 - sedimentation.
 - the coagulation and flocculation processes.
51. Five grains per gallon is _____ mg/L.
- 35
 - 58
 - 86
 - 506
52. Hydrogen sulfide in well water will cause the water to have an odor similar to
- ammonia.
 - chlorine gas.
 - rotten eggs.
 - fish eggs.

53. Which laboratory test in a water plant is concerned with indicator changes at pH 8.3 and about pH 4.5?
- total hardness
 - total chlorine residual
 - pH
 - alkalinity
54. Which one of the following types of pumps works on the basis of inertia or mass moving in a circular motion?
- air lift
 - centrifugal
 - diaphragm
 - gear
55. The purpose of the jar test is to determine the
- amount of chlorine to add for breakpoint chlorination.
 - correct amount of coagulant to use for proper coagulation.
 - length of the flash mix.
 - proper amount of mixing and settling time to remove turbidity.
56. The indicator methyl orange is used in the test for
- alkalinity.
 - chlorine residual.
 - pH.
 - total hardness.
57. Hardness in water is caused mainly by the presence of
- calcium and magnesium compounds.
 - iron and manganese compounds.
 - lime and soda ash.
 - turbidity and suspended solids.
58. Water that is high in sulfate can cause
- diarrhea.
 - hardening of the arteries.
 - mottling of tooth enamel.
 - 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.
- 188
 - 201
 - 248
 - 300
60. A number of grab sample test results that are averaged together constitute
- a composite test result.
 - a poor analytical procedure.
 - an average concentration.
 - grounds for violating state or federal regulations.

61. The term aeration is defined as bringing water into intimate contact with
- air.
 - carbon dioxide.
 - hydrogen sulfide.
 - 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?
- air lift
 - centrifugal
 - diaphragm
 - piston
63. A tank holding 2340 gal fills in 12 min. The rate of flow is _____ gpm.
- 195
 - 234
 - 284
 - 382
64. The chlorine room should be constructed so it can be entered only from the
- inside of the building.
 - laboratory.
 - outside and inside of the building.
 - 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.
- 86,400
 - 646,272
 - 720,576
 - 800,000
66. Destruction of harmful bacteria by chlorine is directly related to
- contact time and chlorine concentration.
 - efficient chlorine dosage levels.
 - whether or not breakpoint chlorination is practiced.
 - whether prechlorination is practiced.
67. What type of treatment should be given when a well produces red water?
- fluoride removal
 - taste and odor control
 - sedimentation
 - pH adjustment, aeration, and filtration
68. The chemical that is most commonly added to reservoirs for the control of algae is
- aluminum sulfate.
 - calcium hypochlorite.
 - copper sulfate.
 - sodium chloride.

69. The standard sample for the multiple-tube fermentation method of testing for coliform bacteria consists of _____ portions.
- ten 5-mL
 - two 10-mL
 - five 10-mL
 - ten 10-mL
70. Recent studies on prechlorination practices point out that the interaction of chlorine with organic matter in raw water forms
- carcinogens.
 - lysergic acid.
 - other odor-related compounds.
 - 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?
- \$5720
 - \$2750
 - \$752
 - \$572
72. The purpose in practicing breakpoint chlorination is to
- eliminate taste and odor.
 - increase the contact time needed to kill disease-causing organisms.
 - produce a free chlorine residual, which is an effective disinfectant.
 - reduce chlorine demand.
73. Bacterial pollution moving underground in shattered limestone
- will be removed in 10 ft.
 - will be removed in 100 ft.
 - will be removed in less than 1 mi.
 - 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?
- 8.34 mg/L
 - 4.17 mg/L
 - 3.6 mg/L
 - 0.5 mg/L
75. The total dynamic head against which a pump must operate
- is the friction head.
 - is the static head.
 - is the sum of the static head and the head due to friction loss.
 - must always be above the shutoff head.
76. A centrifugal-type pump should never be run empty except momentarily because
- a serious counterpressure would be built up by excessive vacuum.
 - it is useless to run a pump without getting water.
 - the excessive end thrust of the shaft would damage the thrust bearing.
 - 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
- stop the motor and repack the stuffing box.
 - put in some heavy oil and then gradually tighten the gland.
 - put in more packing.
 - ignore the condition.
78. Optimum coagulant dosage can be established by
- observing the pilot filter.
 - performing jar tests.
 - performing total solids tests.
 - 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"?
- stabilization
 - saturation
 - precipitation
 - 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?
- 100 lb
 - 150 lb
 - 175 lb
 - 200 lb
81. Corrosive waters can be the result of the presence of
- acids.
 - calcium.
 - magnesium.
 - organic material.
82. A substance added to water to promote the formation of a protective film in transmission pipes is known as
- a pacifier.
 - a passivator.
 - an inhibitor.
 - 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?
- 15 lb
 - 31 lb
 - 60 lb
 - 150 lb

84. The volume of water contained in a storage tank 14 ft in diameter and 20-ft deep is approximately _____ ft³.
- 900
 - 2000
 - 3100
 - 4200
85. Bluestone is a
- common name for copper sulfate.
 - mineral in water that causes blue stains.
 - mineral not dissolvable in water.
 - stone for sharpening chisels.
86. The outlet of a forced ventilation system for a chlorinator room should be located
- above the window.
 - near the floor.
 - on the roof.
 - 6 ft above the floor.
87. Water leaking to the surface after operating an old valve probably is caused by
- a broken stem.
 - dried out packing.
 - plugged weep holes.
 - none of the above.
88. Pathogens are best described as
- an acute case of indigestion.
 - an indicator test for viruses.
 - cancer-producing agents.
 - disease-causing organisms.
89. How are valves checked to determine that they are holding properly?
- by compressed air
 - by electrostatic test
 - by a pressure test
 - by a torque wrench
90. Activated carbon is used to reduce
- alkalinity.
 - hardness.
 - pH.
 - tastes and odors.
91. How many gallons does 1000 ft of 15-inc.-diameter pipe contain?
- 64 gal
 - 1227 gal
 - 2295 gal
 - 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?
- chloride
 - nitrate
 - sodium
 - sulfate
93. A chemical commonly used for coagulation in water treatment is
- alum.
 - chlorine.
 - copper sulfate.
 - soda ash.
94. The disinfection process kills
- all bacteria.
 - only protozoans.
 - pathogenic bacteria.
 - 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?
- 10 lb/d
 - 40 lb/d
 - 70 lb/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?
- 2.5 ft
 - 5.6 ft
 - 25.5 ft
 - 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?
- 33.33 lb
 - 66.67 lb
 - 100.00 lb
 - 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?
- 2 h 10 min
 - 3 h 48 min
 - 4 h 27 min
 - 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

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|-------|-------|-------|---------|
| 1. c | 26. b | 51. c | 76. d |
| 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 |
| 25. b | 50. c | 75. c | 100. c. |