

Water Treatment Study Guide

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

1. If a routine turbidity sample exceeds the maximum contaminant level, the utility should
 - a. change the sample-point location.
 - b. take a check sample within 1 hr.
 - c. take a check sample the next day to obtain an average for two consecutive test results.
 - d. throw out the sample and substitute the average NTU value for the preceding month.

2. Oxidation and aeration are
 - a. two processes for removing or modifying constituents.
 - b. the methods to remove troublesome gases.
 - c. physical changes that take place with water quality during aeration.
 - d. effective in eliminating tastes and odors.

3. The effective pH range for hydrogen sulfide removal is
 - a. 6 or less.
 - b. 7.
 - c. 8 to 9.
 - d. not applicable to this constituent.

4. If no gas has formed in the inverted vials after the first 24 hrs. of incubation in the presumptive test
 - a. coliform bacteria, if present, have been inactivated.
 - b. the culture must be incubated for another 24 hrs.
 - c. the test is negative and no further testing is required for total coliform.
 - d. there is the possibility of laboratory error.

5. Occasionally some of the people on a work crew will indulge in active horseplay. This should be
 - a. discouraged because some of the workers might not like it.
 - b. encouraged because it promotes good fellowship.
 - c. permitted as it is a form of relaxation.
 - d. stopped immediately because it is likely to cause an accident.

6. 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 number and strength of floc particles.
 - d. increasing the detention time for floc formation.

7. A foreman's monthly report should include
 - a. last time supervisor read report.
 - b. number of complaints received and investigated.
 - c. number of monthly reports prepared.
 - d. number of qualified workers available.

8. Public notification for an acute maximum contaminant level violation in a community water system must take the form of
 - a. mail.
 - b. mail and newspaper.
 - c. mail, newspaper and broadcast.
 - d. radio or TV broadcast.

9. Rapid-sand filters can be installed with control devices consisting of a rate-of-flow controller, loss-of-head indicator, and
 - a. auxiliary scour.
 - b. on-line turbidimeter.
 - c. pilot filter.
 - d. underdrain sensor.

10. Oxygen supersaturation should be avoided to
 - a. improve the softening process.
 - b. make appropriate pH adjustments.
 - c. reduce the cost of chlorination.
 - d. retard or prevent corrosion.

11. Corrosive chemicals are usually pumped with a _____ pump.
 - a. diaphragm
 - b. piston
 - c. plunger
 - d. rotary

12. Two chemical compounds that should never be stored together are calcium oxide and
 - a. alum.
 - b. calcium hydroxide.
 - c. soda ash.
 - d. sodium hydroxide.

13. Routine bacteriological and chemical reports must be submitted to the appropriate regulatory agency by a utility doing the testing
 - a. as they are completed.
 - b. the last day of each quarter.
 - c. within 14 days of the analyses.
 - d. within the first 10 days following the month of analyses.

14. The heat generated during lime slaking
 - a. accelerates the slaking process.
 - b. creates caking problems with the lime feeder.
 - c. interferes with the slaking process.
 - d. should be maintained within a range of 60-90°F for best results.

15. If fluoride is added ahead of filtration
 - a. some fluoride loss will occur.
 - b. problems with disinfection will occur.
 - c. increases in fluoride concentration will occur.
 - d. a precipitate will form.

16. If dry powdered activated carbon is transferred to a day tank in the form of a slurry, it is important that
 - a. the tank be monitored frequently for heat generation.
 - b. the slurry be kept in suspension.
 - c. cooling towers be installed.
 - d. cathodic protection be practiced.

17. When using diquat or endothal for the control of aquatic plants, it is important to
 - a. determine if the wind is favorable.
 - b. determine the appropriate waiting time before the water can be used.
 - c. shut down the treatment plant.
 - d. use approved application equipment.

18. The maximum contaminant level for turbidity is _____ NTU as measured with a nephelometer or turbidimeter.
 - a. 1
 - b. 3
 - c. 5
 - d. 10

19. Your chlorinator breaks down and you decide to feed a sodium hypochlorite solution containing 15 percent chlorine as a temporary measure. Six milligrams per litre of chlorine are required for a 1.8 million gallon pumped in 18 hrs. How many gallons per hour of the hypochlorite solution will be required? Assume specific gravity 1.0.
 - a. 2.67
 - b. 3.00
 - c. 4.00
 - d. 5.00

20. At least once a year a filter bed should be
 - a. taken out of service.
 - b. restratified.
 - c. replaced.
 - d. probed for gravel displacement.

21. One opening has become available that would be an advancement to any one of three qualified eager employees. How should this situation be handled?
 - a. Hire an outsider to fill the position.
 - b. Pick one and notify all personnel of the change.
 - c. Split the work between the three and leave the position open.
 - d. Talk to the three as a group, explain the situation, and make your selection. Then notify all personnel of the change.

22. The rate of galvanic corrosion depends largely on
- whether flow rates are constant or variable.
 - the similarity of metals used in household plumbing systems.
 - how widely two metals are separated in the galvanic series.
 - how the corrosion index is interpreted.
23. A 40-hp motor runs an average of 16 hr per day. What will the monthly power cost be if the motor is 80 percent efficient and electricity costs \$0.02/kW-h? Assume 1 month equals 30 days.
- \$358.00
 - \$573.00
 - \$859.00
 - \$965.00
24. Which one of the following characteristics of water is a chemical characteristic?
- alkalinity
 - bacteria
 - suspended colloidal matter.
 - turbidity.
25. The atomic absorption technique is used to measure
- alkalinity.
 - concentration of metals.
 - dissolved oxygen.
 - radioactivity.
26. The number of bacteriological water samples to be taken per month for any given water system is based on
- average monthly demand as calculated from the minimum and peak months
 - population served.
 - the complexity of the distribution system's configuration.
 - the number of service connections.
27. Head loss, filter-effluent turbidity and length of filter run are each considered independently in determining
- when a filter needs backwashing.
 - the frequency of media replacement.
 - the benefits from using filter aids.
 - filter flow rates.
28. If the recommended holding period, type of container and preservation methods are the same for several chemical constituents
- a separate sample must be collected for each constituent.
 - a single sample of sufficient volume may be used for analysis.
 - composite sampling is recommended.
 - the sample volume for each is the same.

29. Modern detergents contain additives call sequestering agents that
- actually soften hard water.
 - form precipitates.
 - prevent hard water from causing problems.
 - "tie up" dirt particles even in the presence of hard water ions.
30. The value of the filterability test is that the test
- measures actual coagulated water in process and is not a laboratory simulation.
 - does not require further turbidity analysis.
 - can be used to monitor filter efficiency.
 - can be easily substituted for the jar test.
31. One of the employees in your crew complains about having to do a hard job. The proper thing to do is
- explain that all employees must do their fair share of the hard work as well as the easier tasks.
 - ignore the complaint.
 - promise that the next assignments will be easier ones.
 - tell the employee to shut up and work or quit and go home.
32. Water rates are
- \$0.50 per 100 ft³ from 0 to 2000 ft³
 - \$0.40 per 100 ft³ from 2000 to 6000 ft³
 - \$0.35 per 100 ft³ from 6000 to 20000 ft³, and
 - \$0.25 per 100 ft³ for 20,000 ft³ and over.
- What is the charge for 1 acre-ft?
- \$108.90
 - \$133.90
 - \$154.00
 - \$163.35
33. The most significant difference between the general properties of powdered activated carbon and granular activated carbon is
- particle size.
 - granular activated carbon is reactivated: powdered activated carbon is not.
 - storage and handling considerations.
 - the type of packing containers used for shipment.
34. Persistent filter binding can be overcome
- by a change in the dose of the coagulant or coagulant aid.
 - by changing the filter media.
 - by frequent backwashing.
 - with filter aids.
35. Two analytical methods used to test for coliform bacteria in water are
- membrane filter method and standard plate count.
 - multiple-tube fermentation and membrane filter methods.
 - multiple-tube fermentation method and standard plate count.
 - total coliform test and standard plate count.

36. Bed life refers to
- manufacturers' specifications regarding the installation of granular activated carbon in pressure columns.
 - the length of time granular activated carbon is held in suspension during backwashing.
 - the replacement of the filter underdrain system at periodic intervals.
 - the time it takes for granular activated carbon to lose its adsorptive capacity.
37. Hydrofluosilicic acid comes in the form of
- crystal, requiring dilution.
 - liquid.
 - powder, requiring dilution.
 - very fine crystal, requiring dilution.
38. The most common operating problem related to the use of powdered activated carbon is
- handling and storing the material.
 - loss of adsorption capacity due to particles becoming coated with floc.
 - selection of the application point.
 - the determination of proper dosage rates.
39. Increased funds for the year are limited. However, two or three outstanding newly employed individuals are grossly underpaid for their services. How should this situation be handled?
- Call a staff meeting, explain the situation, and then raise their salaries.
 - Don't give anyone a raise.
 - Pass the word that there will be raises but change their titles, not their duties, and raise their pay.
 - Say nothing and do nothing because it is none of the employee's business.
40. In addition to precipitating calcium carbonate, treatment techniques can form a protective coating in the distribution system with the use of
- asphaltic-plastic material.
 - cement mortar.
 - carbon dioxide.
 - polyphosphates.
41. A maximum contaminant level is the
- numeric value to contaminants indicating a degree of health hazard.
 - maximum contaminant level, always expressed in milligrams per litre (mg/L).
 - indicator of safe drinking water.
 - highest allowable concentration of a particular contaminant in drinking water.
42. A common requirement for the chemical storage of quicklime and soda ash is that the compounds should be stored
- in a dry area.
 - in elevated bins.
 - separately to ensure that different loading and handling equipment are used.
 - together to simplify loading and handling procedures related to chemical feeding.

43. A motor pulls 4 A at 44 V uses
- 110 W.
 - 440 W.
 - 880 W.
 - 1760 W.
44. Pinpoint floc, fish eyes and high turbidity in settled water are indicators of
- operating problems that require further investigation.
 - inadequate flash mixing.
 - inadequate detention time in the flocculator.
 - improper solution preparation.
45. The effect of partially closing the discharge valve on a three-phase, induction motor-driven centrifugal pump would be to
- cause the motor to draw less amperage.
 - cause the motor to run hotter.
 - cause the motor to run slower.
 - cause the pumped water to get colder.
46. During the backwash cycle, the backwash rate must be high enough to
- provide for proper bed stratification.
 - prevent media loss.
 - cause the media grains to agitate violently and rub against each other.
 - allow the operator to observe the media.
47. An operator desires to disinfect 100,000 gallons of water in storage with a dose of 50 mg/L of chlorine. He has 60 lb of HTH, which is 65 percent available chlorine, and dumps it all in. This was
- the right amount.
 - too much.
 - not enough.
48. If sodium fluoride solution is used with water containing hardness in excess of 75 mg/L as CaCO_3 , it is recommended that
- total hardness be reduced by the lime-soda ash process or ion-exchange method, whichever is appropriate.
 - the make-up water be softened.
 - hydrofluosilicic acid be substituted.
 - hydrofluosilicic acid be used and diluted.
49. Finished-water sample points are normally monitored for
- pH.
 - final pH, alkalinity and bacteria.
 - chlorine residual and turbidity.
 - bacteria, chlorine residual and turbidity.
50. A softening curve is plotted from
- visual observations made with the aid of a stirring rod.
 - jar tests and testing process performance.
 - calculating the Langelier index.
 - a series of calculations using the conversion-factor method.

51. At a minimum, analyses on water from a granular activated carbon contactor should include the threshold odor test, analyses for the removal of any organic compounds of concern, and the
 - a. analysis for trihalomethanes.
 - b. carbon test.
 - c. filterability test.
 - d. standard plate count.

52. Control tests for conventional gravity filters using granular activated carbon as a filter media
 - a. are not required for filter control.
 - b. are the same as for conventional gravity filters.
 - c. can be fewer than those conducted on conventional filtration because of the high performance of granular activated carbon filter media.
 - d. include control tests for both the filtration and adsorption process.

53. A condition that tends to increase the corrosiveness of water is
 - a. high calcium content.
 - b. high dissolved oxygen.
 - c. low dissolved oxygen.
 - d. low total dissolved solids.

54. When an employee refuses to observe safety requirements because the employee "has learned over the years that they are useless," what action should the immediate supervisor take?
 - a. approve of the employee's action
 - b. initiate immediate disciplinary action
 - c. make the employee sign a hold-harmless agreement
 - d. tell other employees to ignore the situation

55. The system that makes use of a constant 4 percent sodium fluoride solution is the
 - a. volumetric feeder.
 - b. saturator.
 - c. gravimetric feeder.
 - d. acid feed installation.

56. A common way to handle alum sludge is to
 - a. convert the sludge into a soil conditioner.
 - b. dump the material in a landfill.
 - c. freeze the material.
 - d. pump the sludge into lagoons.

57. The process used to remove organic substances from depleted activated carbon is called
 - a. degasification.
 - b. reactivation.
 - c. recarbonation.
 - d. reduction.

58. Which of the following conditions, when found in a water supply, would tend to increase the corrosiveness of the water on metals?
- high alkalinity
 - high dissolved carbon dioxide content
 - low dissolved oxygen
 - low dissolved mineral salts
59. Dissolved lead and cadmium can have harmful public health effects in the form of
- waterborne-disease outbreaks.
 - toxicity.
 - ingestive disorders.
 - depression.
60. If one were to select the optimum coagulation dosage on the basis of plotting jar test results, the optimum dosage would probably be
- at some level beyond which there would be little additional turbidity removal without considerable additional cost for chemicals.
 - at some level beyond which additional turbidity removal is significant with relatively small increases of the chemical coagulant.
 - made on the basis of the least amount of chemical addition.
 - made on the basis of costs related to filter head loss and filter runs.
61. If fluoride feed equipment is equipped with a continuous analyzer that automatically adjusts the feed rate, it is a good practice to
- have automated controls checked annually under a service contract with the manufacturer.
 - preset the dosage concentration slightly higher than the calculated dosage.
 - preset the dosage concentration slightly below the calculated dosage.
 - test samples routinely to verify the accuracy of the analyzer.
62. Alkalinity, pH, water temperature, turbidity and mixing action are all
- control testes that should be conducted on the coagulation - flocculation process.
 - control tests that should be conducted in selecting appropriate coagulants and coagulant aids.
 - factors that can affect good floc formation.
 - relatively unimportant if the jar test is performed routinely as a monitoring tool.
63. Test results from sampling immediately after aeration should show that there has been a reduction in
- algae and associated tastes and odors.
 - bacteria.
 - dissolved gases.
 - organic chemicals.

64. It is recommended that nephelometric turbidimeters be used to monitor filtered water because
- filter performance information can be compared with other facilities if the nephelometric method is practiced.
 - they are less costly than conventional turbidimeters.
 - they are sensitive to turbidity levels below 1 NTU.
 - this recommendation is advocated by most state and federal water supply agencies.
65. A change in treatment operations following chemical application for the control of algae would probably include
- decreases of coagulant dosage.
 - increases in chlorine demand.
 - increases in filterable residue.
 - shorter filter runs.
66. The primary feature of the solids-contact process is one in which
- coagulation, flocculation and sedimentation are combined into one treatment unit.
 - inclined tube settlers are installed.
 - solids are permitted to recycle.
 - the flow rectilinear.
67. The influent into the treatment plant has high color and a turbidity of 0.05 NTU. Improved flocculation can usually be achieved by
- using iron salts for coagulation.
 - prechlorination.
 - increasing the alum dosage.
 - adding bentonite clay at the flash mixer.
68. The concentration of organic chemicals in water is usually determined by using
- a gas chromatograph.
 - a spectrophotometer.
 - amperometric titration.
 - the atomic absorption technique.
69. To properly train a new employee, you should
- allow the employee to make errors without correcting him, figuring he'll learn in time.
 - have him wait to try a new operation until he can perform it perfectly.
 - keep him away from older employees until you have had a chance to train him your own way.
 - pace carefully the amount of new material you give him to learn.
70. A factor that has little effect on the successful operation of a solids-contact basin is the
- height of the sludge blanket.
 - mixing speed.
 - type of sludge residues that accumulate in the basin.
 - weir overflow rate.

71. Scales are not required for fluoride installations using
- acid-feed systems.
 - dry-feed systems.
 - saturators.
 - solution-feed systems.
72. Sample preservation usually involves
- refrigeration.
 - refrigeration and pH adjustment.
 - freezing.
 - deionization and refrigeration.
73. A Langelier Index of -3.0 indicates
- nonaggressive water.
 - moderately aggressive water.
 - highly aggressive water.
 - low pH.
74. The coliform bacteria test is used to indicate the bacteriological quality of water because
- coliforms are the only bacteria found in water.
 - it was the first test developed.
 - it would be impossible to test rapidly and economically for every pathogen that might be present.
 - no techniques exist to test for other microorganisms.
75. When the impeller in a centrifugal pump becomes worn after use, the amount of energy used will be _____ the amount used by a similar, new pump.
- erratic, sometimes more than and sometimes less than
 - less than
 - more than
 - the same as
76. A turbine pump set at a rate of 500 gpm is pumping water through a 6-inch pipeline. How fast is the water traveling?
- 0.168 ft/s
 - 5.68 ft/s
 - 28.3 ft/s
 - 448 ft/s
77. Fluoride in excessive amounts causes
- fluorosis.
 - hair loss.
 - hardening of the arteries.
 - heart disease.
78. What is the main reason for the poor accident record of operators?
- exhaustion
 - lack of interest
 - lack of training
 - rushed by supervisor to complete the job

79. In cases where carbon dioxide gas is produced in a submerged combustion chamber or purchased in some form for stabilization, extreme care must be taken to
- apply a protective coating on all submerged piping.
 - control resulting taste and odor problems.
 - install an adequate ventilation system.
 - post "no smoking" signs.
80. The chlorine demand of a certain water is 3 mg/L. The operator treats 250,000 gallons of water with 10 lb. of chlorine gas. The chlorine residual is ____ mg/L.
- 1.8
 - 3.0
 - 4.8
 - 6.0
81. Copper sulfate dosage calculations for water with a total methyl-orange alkalinity equal to or greater than 50 mg/L as CaCO_3 are usually treated at a dosage of 1 mg/L calculated for the
- per acre of surface area.
 - per acre-ft of volume.
 - upper 2 ft regardless of depth.
 - upper 4 ft regardless of depth.
82. Non-community water systems are required to monitor for certain contaminants because
- health problems can occur even with intermittent users of drinking water.
 - most non-community systems operate seasonally.
 - sewage systems at campgrounds are usually inadequate.
 - all of the above.
83. Softening water high in color concentration would probably require
- conventional alum coagulation before softening.
 - excess-lime treatment.
 - special pH adjustments.
 - the use of polystyrene resins in the ion-exchange process.
84. When normal backwash rates are insufficient to thoroughly clean the filter media, it is recommended that
- the stratification of media be changed before the next filter run.
 - the media be replaced.
 - auxiliary surface-wash equipment be installed.
 - a flow restricting orifice be placed in the effluent line of the filter.
85. If activated carbon particles become coated with floc, they will
- become more effective as a filter media.
 - lose adsorptive capacity.
 - not separate during backwash.
 - none of the above.

86. Trihalomethanes are formed by the reaction of certain organic compounds in the water with
- ozone.
 - free chlorine.
 - fluoride.
 - aluminum sulfate.
87. For continuous and effective removal of turbidity and most organic compounds causing tastes and odors, the minimum depth of granular activated carbon as a filter media is recommended to be
- not less than 12 in.
 - 24 in.
 - 36-42 in.
 - none of the above.
88. The problems associated with chlorine, iron, turbidity, organic color and bacterial slime in the ion-exchange process can
- be corrected by other treatment processes at little additional cost.
 - generally be predicted with seasonal accuracy.
 - reduce the exchange capacity of the resin bed.
 - seriously affect the backwash cycle.
89. Slime, corrosion, toxicity, filter clogging and tastes and odors are all associated with
- improper pretreatment facilities.
 - diatoms.
 - an unprotected watershed.
 - algae.
90. Violent, upswelling boils of water during the backwash process can indicate
- gravel bed upset or clogged under-drains.
 - terminal head loss has been reached.
 - the pressure in the bed is less than atmospheric.
 - the rate of flow controller is set too high.
91. A variance may be granted to a public water supply when it
- cannot afford an improvement.
 - does not agree with EPA that an improvement is needed.
 - is demanded by the mayor and city council.
 - is unable to meet an MCL due to characteristics of the raw water, despite use of the best available technology.
92. Which of the following fluoride compounds contains the greatest percentage of fluoride?
- fluosilicic acid (H_2SiF_6)
 - sodium fluoride (NaF)
 - sodium silicofluoride (Na_2SiF_6)
 - all are about the same

93. Continuous turbidity monitoring of pressure-sand filters is an essential operating requirement because
- there are problems with filter overrun.
 - the filtration process takes place at a higher rate.
 - the filter bed cannot be observed for problems during operation.
 - this type of filtration process is commonly used to filter groundwater, which has minimal treatment for turbidity removal.
94. The maximum contaminant level to total trihalomethanes for water systems serving 10,000 or more and using an oxidant as a disinfectant is
- 0.05 mg/L.
 - 0.1 mg/L.
 - 0.15 mg/L.
 - none of the above.
95. What is the most important and all-inclusive aspect of supervision?
- proper utilization of people.
 - proper utilization of finances
 - proper utilization of equipment
 - proper utilization of all resources
96. Once a sample has been collected, its quality begins to change because of
- chemical and biological activity.
 - contamination.
 - exposure to sunlight.
 - preservatives that have been added.
97. Word has just come down from the top that operating funds are being cut. How should this be handled?
- Cut the supplies and repairs to balance the budget.
 - Fire some of the less productive employees.
 - Fire some of the new employees.
 - Let the other personnel know what the situation is and ask for their help.
98. A water treatment plant produces 850,000 gpd. On one day 24,527 gallons was used for backwashing the filters. What percent of the total daily production does the backwash water represent?
- 34.6%
 - 28.9%
 - 20.8%
 - 2.9%
99. When a citizen wants information from you regarding some phase of your work, you should
- always refer the citizen to someone higher up.
 - explain that you are not authorized to give information to outsiders.
 - give as much factual information as possible.
 - give out as few facts as possible, so you won't be responsible for any mistakes

100. Disaster planning is
- having manuals ready so they can be read if a disaster occurs.
 - something that, if properly done, will not need to be revised.
 - useful in reducing confusion in the event of a disaster.
 - none of the above.
101. The operation of the rate of flow controller
- is at a higher rate for rapid sand filters than for high rate filters.
 - determines the length of filter runs.
 - compensates for head loss.
 - cannot be automated.
102. The Langelier Index and coupons in the distribution system can be best described as
- analytical test procedures used to monitor the ion-exchange softening process.
 - analytical test procedures used to monitor the lime-soda ash softening process.
 - methods used to determine carbonate hardness.
 - monitoring procedures used to evaluate the stability of water.
103. A cylindrical tank has a height of 8 ft and a diameter of 10 ft. It is filled with water. A chemical is to be added so that the concentration will be 0.45 grains per gallon. How many grams of the chemical must be used?
- 3700 g
 - 731 g
 - 250 g
 - 137 g
104. During the fall when the water temperature drops, a possible coagulation operational problem at the filtration plant is
- floc carryover from the sedimentation process.
 - high alkalinity.
 - odor problems.
 - trihalomethane formation.
105. Granular activated carbon is often selected instead of powdered activated carbon where
- trihalomethane levels exceed 10 mg/L.
 - prechlorination is practiced.
 - plant location is such that powdered activated carbon dust would cause problems for nearby industry or residences.
 - continuous removal of organics is required.
106. Which one of the following characteristics distinguishes a "strong" acid from a "weak" one?
- pH
 - production of hydroxyl ions (OH)
 - classification as a monoacid
 - degree of ionization in a water solution

107. The air into water diffuser type aerator is primarily effective for
- controlling the size of air bubbles.
 - increasing the dissolved oxygen content of water.
 - oxidizing certain minerals.
 - removing the carbon dioxide gas.
108. Specific conductance provides an estimate of
- dissolved solids.
 - hardness.
 - pH.
 - trace elements.
109. If direct filtration is practiced, it is important to carefully monitor the process because
- special reporting requirements to the state or EPA are made on daily turbidity units.
 - of the short time between coagulation and filtration and the high filter loading rates.
 - direct filtration requires more frequent backwashing than does conventional filtration.
 - direct filtration is commonly used to filter waters with high turbidity.
110. Your shift operator calls you at home and informs you that a chlorine tank in the plant is leaking and cannot be stopped. What should you do first?
- Call the chlorine manufacturers for instructions.
 - Contact the police department and advise of the possible dangers of chlorine gas to residents downwind from the leak.
 - Get over to the plant as fast as possible.
 - Tell the operator to keep you posted.
111. Microstraining is the treatment technique that is normally designed to remove _____ from the water.
- algae and coarse suspended solids
 - fish, logs and large debris
 - iron and manganese
 - all of the above
112. One potential problem that must be monitored when using granular activated carbon as a filter media is
- black water.
 - early head loss.
 - filter binding.
 - media losses.
113. A carbon dosage of 20 mg/L is applied at the pump station preceding the plant. The 36 in. force main is 23,000 ft long and the flow is 5560 gpm. What is the theoretical contact time for the carbon prior to entering the plant?
- 1 h 48 min
 - 2 h 24 min
 - 3 h 38 min
 - 4 h 4 min

114. The annual operating costs at a water treatment plant were

Salaries = \$8650

Chemicals = \$7864

Power = \$5381

Miscellaneous = \$689

What was the total annual operating cost?

a. \$22,584

b. \$21,000

c. \$14,799

d. \$13,943

Water Treatment Class IV

1	b	24	a	47	c	70	c	93	c
2	a	25	b	48	b	71	c	94	b
3	a	26	b	49	d	72	b	95	d
4	b	27	a	50	b	73	c	96	a
5	d	28	b	51	d	74	c	97	d
6	a	29	c	52	d	75	c	98	d
7	b	30	a	53	b	76	b	99	c
8	c	31	a	54	b	77	a	100	c
9	b	32	b	55	b	78	c	101	c
10	d	33	b	56	d	79	c	102	d
11	a	34	a	57	b	80	a	103	d
12	a	35	b	58	b	81	c	104	a
13	d	36	d	59	b	82	a	105	d
14	a	37	b	60	a	83	a	106	d
15	a	38	a	61	d	84	c	107	b
16	b	39	a	62	c	85	b	108	a
17	b	40	d	63	c	86	b	109	b
18	a	41	d	64	c	87	b	110	b
19	c	42	a	65	a	88	c	111	a
20	d	43	d	66	a	89	d	112	d
21	d	44	a	67	d	90	a	113	c
22	c	45	a	68	a	91	d	114	a
23	a	46	c	69	d	92	a		