

WATER EXAM 2

1. Which of the following is used as a chemical coagulant?
 - a. calcium chloride
 - b. alum
 - c. lime
 - d. soda ash

2. The correct order of treatment in a surface water plant is:
 - a. filtration, disinfection, softening, and coagulation
 - b. sedimentation, flocculation, softening, and coagulation
 - c. coagulation, flocculation, sedimentation, and filtration
 - d. flocculation, coagulation, filtration, and sedimentation

3. In determining the proper dosage of alum, the most useful test is the _____ test:
 - a. marble
 - b. jar
 - c. carbonate
 - d. pH

4. If sludge is not continually removed from the sedimentation basin, its accumulation results in:
 - a. turbidity
 - b. hardness
 - c. alkalinity
 - d. higher pH

5. The most widely used coagulant is:
 - a. chlorine dioxide
 - b. aluminum sulfate
 - c. calcium hydroxide
 - d. ferrous oxide

6. Optimum flocculation requires:
 - a. violent agitation
 - b. gentle agitation
 - c. high pH
 - d. low pH

7. Dissolved iron in excessive amounts results in consumer complaints about:
 - a. hardness
 - b. corrosion
 - c. smell
 - d. turbidity

8. The most important raw water constituent for a surface water plant is:
 - a. temperature
 - b. hardness
 - c. turbidity
 - d. pH

9. Turbidity in water is caused by the presence of:
 - a. alkalinity
 - b. suspended materials
 - c. microorganisms
 - d. hardness

10. The main purpose of the jar test is to determine the best:
- filtration rate
 - detention time
 - coagulant dosage
 - chlorine residual
11. The formation of chlorine ice affects chlorine feed rate. This can be prevented by:
- using a special chlorine gas gauge
 - decreasing the rate of chlorine withdrawal
 - increasing the temperature of the cylinder
 - using a higher output regulator
12. The fusible metal plug on a chlorine cylinder is designed to open at what temperature range:
- 105 to 112 F
 - 136 to 145 F
 - 157 to 162 F
 - 200 to 212 F
13. A lantern ring is a:
- ring used to hold pipes in place
 - metal ring used to lower a gas monitor into a confined space.
 - spacer ring in a pump packing gland
 - type of pipe coupling
14. When backwashing a filter, the backwash valve should be opened slowly to prevent:
- sand boils
 - expansion of the filter media
 - a turbid effluent
 - mudball formation
15. Suction lift refers to the pressure difference between the center line of the pump:
- up to the energy grade line
 - up to the hydraulic grade line
 - down to the inlet of the suction pipe
 - down to the hydraulic grade line
16. The parameter used to describe the roughness of the pipe interiors is called:
- hydraulic factor
 - C factor
 - F/M ratio
 - D factor
17. The finished water from the treatment plant has a chlorine demand of 0.3 mg/l. If you want to have a chlorine residual of 2.0 mg/l, how many pounds of chlorine gas would be needed to disinfect 1.2 MGD?
- 15 lbs.
 - 23 lbs.
 - 32 lbs.
 - 41 lbs.
18. Prechlorination of raw water can lead to an interaction of chlorine with organic matter which can form:
- lysergic acid
 - hydrogen sulfide
 - odor related compounds
 - trihalomethanes

19. A rectangular tank measures 80 ft. long, 30 ft. wide, and 20 ft. deep. If 100,000 gallons of water were pumped into the tank, what would be the water rise in the tank?
- 2.5 feet
 - 5.6 feet
 - 15.6 feet
 - 18 feet
20. The chlorine dose for a water is calculated to be 3.2 mg/l. How many gallons of sodium hypochlorite would be needed if the available chlorine content of the solution is 12% by weight and the flow is 3 MGD?
- 45 gallons
 - 80 gallons
 - 120 gallons
 - 667 gallons
21. Which of the following is the main purpose of the coagulation/flocculation process?
- to remove turbidity
 - to soften the water
 - to add oxygen
 - to disinfect.
22. Which of the following conditions most affect coagulation performance?
- velocity, chlorine dosage, detention time, and air temperature
 - velocity, water temperature, detention time and coagulant dosage
 - water temperature, detention time, air temperature, and chlorine dosage
 - detention time, velocity, air temperature, and chlorine dosage
23. Which of the following parameters would be the best indicator that the filter should be backwashed?
- filter service hours
 - head loss
 - filter effluent turbidity
 - filter encrustation
24. The most crucial element of effective filter performance is:
- water temperature
 - media density
 - effective size of the filter media
 - proper backwashing
25. A filter has dimensions of 100 ft. by 40 ft. is backwashed at 70,000 gpm, what is the backwash rate?
- 15 gpm/sq. ft.
 - 17.5 gpm/sq. ft.
 - 19.5 gpm/sq. ft.
 - 21 gpm/sq. ft.
26. What is the chemical formula for calcium hypochlorite?
- Cl_2
 - $\text{Ca}(\text{OCI})_2$
 - NaOCl
 - NaCl
27. A violation of the maximum contaminant level (MCL) for total trihalomethanes occurs when
- a single sample exceeds the MCL.
 - an original sample and an additional check sample both exceed the MCL.
 - more than 50% of the samples in a given monitoring period exceed the MCL.
 - the running average of quarterly samples during the previous 12 months exceeds the MCL.

28. *CT* is defined as
- the contact time of disinfectant with water.
 - the product of residual disinfectant concentration and contact time of the disinfectant with water.
 - the ratio of the total disinfectant concentration and the residual disinfectant concentration.
 - none of the above
29. Which of the following waters would have the highest concentration of hypochlorous acid?
- pH of 7
 - pH of 8
 - pH of 9
 - pH of 10
30. A gas chlorinator is set to feed chlorine at a rate of 7.5 lbs./day into a daily average flow of 1,500,000 gallons. The chlorine residual is 0.4 mg/l. Find the chlorine demand.
- 0.2 mg/l
 - 0.3 mg/l
 - 0.5 mg/l
 - 0.7 mg/l
31. What is the solution used to regenerate a zeolite softening unit?
- calcium chloride solution
 - caustic soda solution
 - sodium chloride solution
 - sodium hypochlorite solution
32. Langelier's index is used to determine:
- corrosiveness
 - alkalinity
 - pH
 - conductivity
33. An effective chemical to raise pH is:
- alum
 - calcium chloride
 - polyphosphate
 - caustic soda
34. Minerals that cause an increase in alkalinity are:
- calcium carbonate and magnesium bicarbonate
 - calcium sulfate and sodium bisulfate
 - sodium chloride and ferrous oxide
 - magnesium sulfate and calcium chloride
35. A problem related to ion exchange softeners is:
- production of hard water
 - increase in sodium content
 - ineffective filtration
 - formation of insoluble solids
36. After a positive test for VOC's in a water supply, how often do you have to test for VOC's?
- weekly
 - monthly
 - quarterly
 - annually

37. In a reservoir, the main water constituent that encourages algae growth is:
- copper sulfate
 - calcium
 - phosphorous
 - sunlight
38. A bubbler measures water level by sensing
- air pressure
 - length of the bubbler line
 - rate bubbling
 - level of the float
39. The primary contaminant that is important to public health is
- bacteria
 - hardness
 - taste and odor
 - iron content
40. Which of the following cannot be controlled in the normal operation of a sand filter?
- air binding
 - mudball formation
 - floc penetration
 - influent turbidity
41. A partial blockage on the intake line of a centrifugal pump may cause:
- water hammer
 - the pump to air lock
 - the pump to loose its prime
 - cavitation
42. Continuous recording of the influent water turbidity is useful in indicating when to
- change the alum dosage
 - change the lime dosage
 - increase the chlorine feed rate
 - add activated carbon
43. If the pressure in a water main is 55 psi and the meter is 17 feet above the main, what is the water pressure at the meter? Ignore friction loss.
- 30 psi
 - 35 psi
 - 38 psi
 - 48 psi
44. Which of the following would most likely improve the coagulation/flocculation process?
- increase in raw water hardness
 - decrease in water temperature
 - increase in water temperature
 - decrease in raw water alkalinity
45. For which water treatment chemical is chemical feeder adjustment most critical because of potential toxicity?
- lime
 - alum
 - sodium fluoride
 - soda ash

46. A polymer is a substance that aids in coagulation. When coagulant aids are used with aluminum sulfate, what is the ratio of coagulant aid to aluminum sulfate?
- 1:1
 - 1:5
 - 1:10
 - 1:50
47. A chemical feed line that is installed after the sedimentation tank and before the filter is used to inject what chemical?
- sequestering agents
 - filter aid chemicals
 - coagulants
 - chlorine
48. A dry chemical feeder is suitable for adding
- chlorine dioxide
 - fluosilicic acid
 - potassium permanganate
 - ammonia
49. Carbon dioxide is used in water treatment to do what?
- disinfect
 - raise pH
 - lower pH
 - stabilize ammonia compounds
50. pH meters should be standardized against
- standard acid titration curve
 - two samples of known pH
 - a standard chemical solution
 - a buffer solution with pH approaching that of the sample
51. A zeolite softening unit will replace calcium and magnesium ions with
- sodium ions
 - chloride ions
 - fluoride ions
 - zeolite ions
52. The liquid form of fluoride that is most widely used in water treatment is
- fluosilicic acid
 - sodium fluoride
 - sodium silicofluoride
 - calcium hypofluorite
53. If the raw water contains 4000 coliform bacteria per ml. prior to chlorination and 40 per 100 ml. after, determine the percent reduction of coliform bacteria prior to infiltration.
- 99%
 - 99.9%
 - 99.99%
 - 99.999%

54. A water tower has a water pressure of 98 psi at its base. What would be the pressure at a hydrant three blocks away if there is a 65-foot head loss in the pipe?
- 45 psi
 - 65 psi
 - 70 psi
 - 98 psi
55. When alum is added to water, a floc is formed from the combination of alum and
- alkalinity
 - acid
 - chlorine
 - lime
56. Successful performance of a sedimentation basin depends greatly upon
- method of removing sand
 - biological action
 - surface settling rate
 - filtration
57. Potassium permanganate is a chemical most often used to
- remove dissolved iron
 - prevent tuberculation
 - remove lead and copper
 - adjust pH
58. Recommended detention times for a sedimentation basin is
- 30 minutes
 - 1 hour
 - 2 hours
 - 4 hours
59. A circular sedimentation basin is 100 feet in diameter and 20 feet deep. It receives a flow of 7,000,000 MGD. What is the detention time?
- 1 hour
 - 2 hours
 - 4 hours
 - 6 hours
60. Giardia lamblia may be removed from a surface water source by
- chlorination
 - filtration
 - fluoridation
 - sedimentation
61. Which one of the following chemicals would be most suitable as a filter aid?
- alum
 - soda ash
 - sodium hydroxide
 - anionic polymer
62. During backwashing, debris is noticed in the filter bed. Which of the following would apply?
- no surface wash
 - insufficient backwash rate
 - too high of a backwash rate
 - this is normal for a sand filter

63. The maximum advisable filtration rate for pressure sand filters is
- 1.0 gpm/sq. ft.
 - 3.0 gpm/sq. ft.
 - 5.0 gpm/sq. ft.
 - 10.0 gpm/sq. ft.
64. Besides disinfection, what else is chlorine used for in water treatment?
- color removal
 - taste and odor control
 - turbidity removal
 - coagulation
65. The amount of chlorine used by organic matter in water is a portion of the:
- chlorine demand
 - chlorine dioxide
 - free available chlorine
 - chlorine residual
66. Chlorine leaks in metal containers tend to:
- become larger
 - become smaller
 - remain the same size
 - become encrusted
67. The purpose of adding ammonia to potable water is to:
- adjust pH
 - form combined chlorine residual
 - remove turbidity
 - protect teeth
68. What would happen if a temporary fluoride feed rate increased to 62 mg/l in the finished water?
- nausea and vomiting would occur in nearly all consumers
 - one glass of water will not harm most individuals
 - the increase will create a greater immunity to cavities
 - it will only affect the elderly
69. It is important to maintain proper exhaust in areas where activated carbon is handled and fed to
- reduce the amount of clean-up
 - prevent inhalation of carbon particles
 - prevent possible explosion
 - reduce a health hazard
70. When 10,000 gallons of 1% sludge is thickened to 5% solids, what's the new volume of sludge?
- 1,000 gallons
 - 2,000 gallons
 - 4,000 gallons
 - 5,000 gallons
71. Determine how many pounds of iron are removed from an iron removal plant in one week given the following: average iron concentration is 0.5 mg/l, flow averages 24 MGD, and removal efficiency is 90%.
- 531
 - 631
 - 731
 - 831

72. Concentration of manganese in excess of 0.05 mg/l may result in
- offensive odor
 - entrained air
 - red water
 - turbidity
73. The purpose of sodium thiosulfate in a microbiological sample bottle is to:
- ensure sterilization of sample bottle
 - extend allowable holding time from 6 to 30 hours
 - remove chlorine residual that may be present
 - react with nitrates that interfere with the MPN test
74. Which of the following does not affect the friction loss in a water main?
- water hardness
 - number of fittings
 - flow velocity
 - pipe interior roughness
75. Samples taken for routine analysis should be preserved by:
- refrigerating
 - filtering
 - boiling
 - sterilizing
76. A method used to soften water is
- aeration
 - sedimentation
 - ion exchange
 - adsorption
77. Pumps that work on the basis of inertia or mass moving in a circular motion are called:
- air lift
 - centrifugal
 - diaphragm
 - piston
78. The vent opening on an aerator should be screened with which size meshed screen?
- 4
 - 8
 - 16
 - 24
79. A ground water well has a bad odor due to hydrogen sulfide at a concentration of 5.0 mg/l. Determine the amount of chlorine required to destroy the H₂S in 100,000 gallons of water? (Note: 2.1 mg/l of chlorine is needed to reduce 1 mg/l of hydrogen sulfide).
- 10 lbs.
 - 12 lbs.
 - 8.75 lbs.
 - 7.85 lbs.
80. If 50 pounds of chlorine is needed to satisfy the chlorine demand, how many pounds of 65% calcium hypochlorite would be used?
- 50 lbs.
 - 68 lbs.
 - 77 lbs.
 - 84 lbs.

81. A sand filter is 20 feet by 40 feet and 10 feet deep. If a backwash rate of 15-gpm/sq. ft. is needed for proper backwash, how many gallons would be needed for a 15-minute backwash cycle?
- 100,000 gallons
 - 150,000 gallons
 - 180,000 gallons
 - 200,000 gallons
82. Determine the percent of water used for backwashing if a plant filters 2.1 MGD and 25,000 gallons of filtered water are used for backwashing?
- 0.64%
 - 0.84%
 - 1.19%
 - 1.68%
83. Estimate the flow rate in a 24-inch pipe in gallons per minute if the flow velocity is 3 feet per second.
- 1170 gpm
 - 3208 gpm
 - 4128 gpm
 - 4228 gpm
84. If you apply 200 pounds of chlorine per day to treat 3.5 MGD, determine the concentration in mg/l.
- 4.25 mg/l
 - 4.85 mg/l
 - 6.25 mg/l
 - 6.85 mg/l
85. A water treatment plant consisting of 6 filters is designed to treat 6.5 MGD. Assuming a filtration rate of 2-gpm/sq. ft., calculate the surface area of each filter.
- 276
 - 376
 - 476
 - 576
86. Aeration in water treatment plants is used to
- remove dissolved gases
 - lower the pH
 - reduce turbidity
 - stabilize the chlorine residual
87. $Al_2(SO_4)_3$ is the formula for:
- aluminum chloride
 - aluminum sulfate
 - aluminum carbonate
 - sodium aluminate
88. Neglecting friction losses, a water line 6 inches in diameter can
- transport more water than two 4 inch lines
 - transport no more than two 4 inch lines
 - not transport as much as two 4 inch water lines
 - be filled only to one half of the cross sectional area
89. Copper sulfate is used primarily to:
- destroy algae
 - precipitate calcium carbonate
 - help prevent corrosion
 - lower pH

90. Water high in sulfates can cause
- diarrhea
 - staining of plumbing fixtures
 - tuberculation
 - mottled tooth enamel
91. Which laboratory test is concerned with indicator changes at pH 8.3 and about pH 4.5?
- total hardness
 - pH
 - alkalinity
 - total chlorine residual
92. Polyphosphates may be used in water treatment to:
- retard corrosion and adjust pH
 - retard corrosion and reduce taste and odors
 - retard corrosion and calcium scale
 - retard corrosion and reduce chlorine demand
93. When operating a surface water plant, which laboratory tests are most significant for establishing dosages for coagulation?
- pH and alkalinity
 - sulfates
 - calcium and magnesium
 - total hardness
94. A carbon dosage of 20 mg/l is applied at the pump station preceding the plant. The 36-inch force main is 23,000 feet long and the flow is 5560 gpm. What is the theoretical contact time for the carbon prior to entering the plant?
- 1 hr 48 min.
 - 2 hr 24 min.
 - 3 hr 38 min.
 - 4 hr 4 min.
95. Alum added to turbid water containing alkalinity forms _____, which increase in size and settle out.
- floc particles
 - coagulants
 - coagulant aids
 - aluminum sulfate
96. Specific conductance provides an estimate of:
- pH
 - dissolved solids
 - hardness
 - alkalinity
97. Anabaena can cause what undesirable characteristic in water?
- color
 - taste and odor
 - coliforms
 - contamination and evaporation

98. If polyphosphates are used to sequester (suspend) iron, where is the best injection point?
- in the well
 - after chlorination
 - before chlorination
 - in the main
99. The average finished water turbidity readings for four consecutive days at a treatment plant were 0.9 ntu, 0.65 ntu, 1.2 ntu, and 0.45 ntu. What was the average turbidity for the four-day period?
- 0.5 ntu
 - 0.65 ntu
 - 0.8 ntu
 - 1.05 ntu
100. Which treatment step is not used with direct filtration?
- Coagulation
 - Flocculation
 - Sedimentation
 - disinfection

WATER TWO ANSWERS

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