



Rev. Feb. 2004

REVIEW QUESTIONS
FOR
Class I

WASTEWATER TREATMENT PLANT OPERATOR'S EXAMINATION

No multiple choice questions on examinations written since 1983 have more than six answers, the average number of answer selections is slightly less than five. This set of review questions consists of the 1982 questions with numerous math question additions. The Class I examination will not consist of anywhere near the number of math questions on this review. Please circle your math answers and show your math calculations.

Circle Answer:

1. In withdrawing digested sludge from an unheated digester to the sludge drying beds, the usual depth of wet sludge applied to the bed is:
 - a. 2 to 2.5 feet
 - b. 2 to 2.5 inches
 - c. 8 to 15 inches
 - d. 1 to 2.0 inches

2. What is a sample made up of a series of samples taken at specific intervals:
 - a. instantaneous sample
 - b. composite sample
 - c. periodic sample
 - d. grab sample
 - e. none of the above

3. Carbon monoxide is not poisonous, but may cause:
 - a. combustion
 - b. corrosion
 - c. burns
 - d. asphyxiation

4. Poorly constructed pipe joints do not:
 - a. permit infiltration
 - b. allow root intrusion
 - c. permit infiltration
 - d. improve treatment efficiency
 - e. destroy the load bearing capacity of the pipe

5. Comminutors are used at sewage plants to:
 - a. remove grease before entering settling tanks
 - b. cut up rags and other debris
 - c. aerate the sewage
 - d. remove sand and grit
 - e. measure the flow

6. Water seal connections to wastewater pumps should not connect directly to a city water supply because:
 - a. city water contains chlorine and fluoride
 - b. city water pressure is too high and can damage a pump
 - c. wastewater may be drawn into the city supply
 - d. dry seals work better
 - e. none of the above

7. The primary purpose of forced ventilation in the lift station is to:
 - a. prevent odors
 - b. cool the pumps
 - c. remove dangerous gases
 - d. equalize the station temperature with the outside temperature
 - e. prevent condensation

8. A disadvantage of a stabilization pond is:
 - a. average removal efficiency less than 85%
 - b. low land cost
 - c. complicated O & M
 - d. unstable effluent
 - e. none of the above

9. At what rate of feed must a chlorinator, reading pounds of chlorine per 24 hours, be set to apply 10 ppm of chlorine to a flow of 1,000 gpm? (Show calculations)
 - a. 60 lbs. per 24 hours
 - b. 100 lbs. per 24 hours
 - c. 120 lbs. per 24 hours
 - d. 200 lbs. per 24 hours
 - e. 240 lbs. per 24 hours

10. A one ton chlorine cylinder develops a small leak. It is best controlled by:
- applying liquid lead putty
 - continuously applying ammonia
 - a Chlorine Institute safety kit
 - dropping the tank in a river or clarifier
11. The best measure of raw sewage strength is:
- weighing it
 - suspended solids test
 - BOD test
 - residual chlorine test
 - doing a tensile strength test
12. What group is essential in determining solids and organic loading?
- flow, BOD, DO
 - BOD, suspended solids, COD
 - flow, COD, BOD
 - suspended solids, BOD, flow
 - flow, temperature, BOD
13. Septic action in a primary clarifier with mechanical sludge removal equipment:
- is inherent to the design of this type of equipment, and indicates normal operation
 - indicates the sludge removal equipment is not operating in a satisfactory manner
 - improves the efficiency of the tanks
14. Coliform bacteria are generally considered:
- indicator organisms
 - the good guys
 - pathogenic organisms
 - air-borne
 - only important in water treatment
15. The normal pH of domestic sewage is:
- 6-8
 - 2-4
 - 4-6
 - 8-10
 - 700

16. Black, odorous primary sludge could be caused by any of the following except:
- preaeration of strong industrial waste
 - septic tanks pumpage
 - industrial waste
 - poor collection system
 - digester supernatant
17. A primary settling tank is 65 ft. long, 20 ft. wide, and 8 ft. average liquid depth. The flow is 500 gpm. What is the detention time? (Show calculations)
- 1.55 hours
 - .76 hours
 - 2.93 hours
 - 2.6 hours
 - 2.1 hours
18. In a wetwell or lift station with two identical pumps, it is best to adjust the controls so that:
- both pumps turn on together
 - one pump always runs and the other is held in reserve
 - the pumps alternate as lead pump
 - one pump is always the lead pump
 - none of the above
19. At the beginning of the day the flow totalizer is 2,813,572 gallons. The next day the reading is 4,612,931. The flow was:
- 0.18 mgd
 - 180,000 gpd
 - 1.8 mgd
 - 17.9 mgd
 - none of the above
20. What wouldn't generally be considered to cause short circuiting:
- sludge drying bed filtrate
 - density currents
 - hydraulic design
 - baffling
 - uneven weir setting

21. The withdrawal of a large proportion of the digested sludge in a digester, followed by the addition of large amounts of raw sludge to the digester, would tend to:

- a. raise the pH of the digester contents
- b. lower the pH of the digester contents
- c. stabilize the pH of the digester contents
- d. not affect digester action

22. Float controls on lift station pumps should be set to operate the pump(s):

- a. frequent enough to prevent septic conditions
- b. every two minutes
- c. until the wetwell is pumped dry
- d. every 30 minutes
- e. all at the same time

23. In starting a positive displacement pump:

- a. close the suction and close discharge valve
- b. close suction valve and open discharge valve
- c. open suction valve and close discharge valve
- d. open suction valve and open discharge valve
- e. none of the above

24. The efficiency of a digester can be evaluated by:

- a. gas production
- b. volatile acids/alkalinity ratio
- c. volatile solids reduction
- d. gasification percentage
- e. a, b, c
- f. b, c, d
- g. a, b, c, d

25. What statement is correct?

- a. When new chlorine cylinders are received, the valve protection caps and covers should be removed and immediately returned to the supplier so that his shipping records will show how many cylinders are on hand at your plant.
- b. Lay 100 and 150 pound cylinders down for storage, so liquid can seal against the cylinders valves (liquid escapes more slowly than gas, should a valve leak occur).
- c. Store cylinders in a well heated (100°C) room to avoid "chlorine ice" formation.
- d. Keep all 100 to 150 pound cylinders restrained or safety chained to sturdy supports, even when empty, except when actually being moved to or from storage.

26. A good preventive maintenance program requires:
- good record keeping
 - a full-time maintenance man
 - more time than it is worth
 - a computer
 - all of the above
27. Over-tightening of the glands on a pump shaft may produce:
- overheated bearings
 - bearing failure
 - faster shaft or sleeve wear
 - all of the above
 - none of the above
28. Supernatant is generally:
- lower in BOD than primary clarifier influent
 - best returned during high flow to provide dilution
 - less putrescible than raw wastewater
 - significant in its effect on plant loading
 - okay if discharged to the chlorine contact tank
29. The purpose of a sludge drying bed is to:
- convert digested sludge into a good fertilizer
 - provide storage space for digested sludge
 - provide for the digestion of sludge
 - provide for the separation of much of the water from digested sludge
30. A maintenance problem with lift station float controls is:
- removal of trash, grease and scum from floats
 - rusting of floats and sprockets
 - mercury poisoning
 - lubrication of floats
 - all of the above
31. If a fuse continues to blow, one should:
- replace it with a higher capacity fuse
 - install a circuit breaker
 - replace it with a lower capacity fuse
 - put new heaters in the magnetic starter
 - inspect the affected equipment to find the cause
 - wire around the fuse so no fuse is necessary

32. Decrease in digester gas production can be caused by:
- high or low organic loading
 - toxic materials
 - proper temperature control
 - inaccurate gas measurement
 - digester mixing
 - a, b, d, e
 - a, b, d
 - a, b, e
33. Sewage gases which accumulate in manholes, covered wetwells, and other poorly ventilated sewage works structures are not normally dangerous to human life and it is seldom necessary to take precautions against presence of such sewage gases.
- True
 - False
34. If the bars on a manually cleaned bar screen are bent or missing, it could:
- decrease chlorine demand
 - reduce digester gas production
 - greatly increase influent BOD
 - cause rag problems in following processes
 - be advantageous
35. When one is working on any piece of electrical equipment, the circuit breaker should be:
- open
 - locked out and tagged
 - tagged
 - closed
 - locked out
36. What features of sludge drying beds favor their use?
- ease of operation and flexibility
 - moist climate and low humidity
 - low maintenance, power and chemical costs
 - require skilled operator and close supervision
 - a and b
 - a and c
 - a and d
 - b and c

37. Oxygen deficiency can be overcome in a lift station by:
- lowering the temperature in the station
 - providing good ventilation
 - sealing off the vents
 - not overloading the pumps
 - increasing the speed of the motors
38. Successful operation of a clarifier depends on:
- surface settling rate and detention time
 - weir overflow rate and proper baffling
 - good operation and maintenance
 - proper scum and sludge removal
 - all of the above
39. Failure to remove grit from wastewater will result in:
- clogging of mechanical equipment
 - clogging of sumps, pipes, and hoppers
 - reduced detention in anaerobic digesters
 - all of the above
 - a and b
 - b and c
40. Excessive primary sludge and scum pumpage:
- encourages digestion
 - decreases digestion heating requirement
 - increases digester gas quality
 - is harmful
 - all of the above
 - none of the above
41. For a medium sized town or city without a major industry or a large number of small industries, what might be a reasonable combination of flow and strength for this influent to the treatment plant?
- 50 gal/cap/day and 75 mg/BOD/l
 - 300 gal/cap/day and 300 mg/BOD/l
 - 100 gal/cap/day and 100 mg/BOD/l
 - 200 gal/cap/day and 200 mg/BOD/l
 - 100 gal/cap/day and 200 mg/BOD/l

42. Sludge should be pumped from the primary clarifier to the digester:
- rapidly, as needed
 - at least weekly
 - only in warm months
 - slowly, and as frequently as needed
 - when a 12% solids level is achieved
43. Grit removal effectiveness is best determined by:
- % total solids
 - % volatile solids
 - suspended solids
 - dissolved solids
 - settleable solids
44. One of the best controls in odor prevention in the collection system, is to:
- keep the lines at least half full
 - keep the lines full
 - slow the velocity to less than 1 ft/sec to allow odor to come out building vents
 - ensure a velocity of 2 to 3 ft/sec
45. A piston or diaphragm pump would be normally used for pumping:
- primary sludge
 - raw sewage
 - primary effluent
 - final effluent
46. What is true of excessively long detention in a primary clarifier:
- may make the final effluent worse
 - always provides a better primary effluent
 - may be caused by infrequent sludge pumping
 - often increases DO in primary clarifiers
47. If the primary sludge is not pumped often enough, the operator may:
- break the flights
 - see gas bubbles rising to the surface
 - have poor quality primary effluent
 - all of the above
 - none of the above
 - a and b only

48. The settleable solids test will not indicate:
- the efficiency of primary clarification
 - changes in influent wastewater character
 - % volatile content
 - volume of primary sludge expected, and hence assist in digester capacity information
49. What pairs of values should, if added together, equal the “total solids” value for a wastewater sample?
- volatile solids and organic solids
 - settleable and suspended solids
 - dissolved solids and volatile solids
 - dissolved solids and suspended solids
 - dissolved solids and fixed (ash) solids
50. “Disinfection” is a process during which:
- wastewater is made sterile
 - pathogenic organisms are killed
 - anaerobic bacteria produce methane
 - anaerobic bacteria are destroyed but not aerobic bacteria
 - lab ware is rinsed
51. What would most accurately determine actual detention in a clarifier or a chlorine contact chamber:
- dye test the tank
 - ask your consulting engineer
 - call the health department
 - divide tank capacity by flow rate
 - time how long it takes a cork to travel the tank length
52. The ability of water to hold dissolved oxygen is:
- increased as the water temperature rises
 - decreased as the water temperature rises
 - is the same regardless of the water temperature
 - varies with the nitrate content of the water
53. Chlorine demand is the difference between chlorine added and:
- the reciprocal of the BOD divided by suspended solids
 - the pH of the wastewater
 - potability
 - the buffering capacity of wastewater
 - the amount of residual chlorine left after a given contact time

54. The purpose of influent clarifier baffles is:
- maintain the proper water level
 - evenly distribute influent flow
 - measure influent flow
 - none of the above
55. Circle correct statement:
- Gooch crucibles are used in suspended solids determinations.
 - Imhoff cones are used in suspended solids determinations.
 - Evaporating dishes are used in suspended solids determinations.
 - A drying oven is used in settleable solids determinations.
56. The best time to control submerged cattails and canary grass in a pond is:
- after the plants become well established
 - continuously as plants appear
 - in the fall
 - when the plants cover one-third of the pond
 - in the spring
57. What condition may occur if primary sedimentation detention is too short?
- decreased organics in primary effluent
 - overloading of the flight drive motor
 - increased primary solids pumping
 - low BOD removal
 - reduced suspended solids to secondary treatment
58. The most effective method of knowing when sufficient sludge has been withdrawn from a primary settling tank is:
- to time the operation of sludge pump
 - to measure the increased volume in digester
 - to note the consistency of sludge by sampling from pump discharge or sludge well
 - to check for rising sludge in settling tank
59. The chlorine solution used for disinfection is:
- well mixed and added at the influent end of the chlorine contact chamber
 - injected before the final clarifier
 - injected at effluent end of the chlorine contact chamber
 - none of the above

60. What could cause inadequate water level in a pond?
- heavy rainfall
 - pond is hydraulically overloaded
 - duckweed
 - pond not sealed
 - cattle grazing
61. House sewers may necessitate strict installation requirements to insure satisfactory operation of a sewer system.
- True
 - False
62. Digester supernatant often causes problems when returned to the plant because it contains:
- high levels of ammonia
 - no dissolved oxygen
 - high oxygen demand
 - large amounts of solids
 - all of the above
63. When starting up a wastewater pond, it is best to add wastewater when the:
- bottom is seeded with sodium nitrate
 - lagoon has at least two feed of water in it
 - cross connection to city water is completed
 - temperature is above 50°F
64. Particularly during our warm summer weather, the more frequent the withdrawal of sludge from a primary settling tank, the better the operation, so long as the water content of the sludge can be held normal.
- True
 - False
65. What are the reasons why sludge is digested and dewatered before disposal?
- reduce solids volume
 - decrease pathogen count
 - stabilize sludge
 - provide supernatant return
 - all of the above
 - a and b
 - a and c

66. Next to maintaining a DO level in an aerated pond, the most important function of an aerator is:
- destroy mosquito larvae
 - provide mixing
 - assist photosynthesis
 - prevent buildings of algae and duckweed mats
 - none of the above
67. A circular clarifier has a depth of 10 feet and a diameter of 40 feet. Calculate the detention time in hours, for a flow of 785 gallons per minute.
- (use 7.5 gallons = 1 cubic foot $\pi = 3.14$; $A = \pi r^2$)
Show calculations on separate sheet, if needed. Circle answer:
- 1.5
 - 2.0
 - 2.5
 - 1.73
68. The best DO range in an anaerobic digester is:
- 1 ppm
 - .1 to 1 ppm
 - greater than 1 ppm
 - no DO
 - none of the above
69. What factor(s) would lower the effectiveness of chlorination:
- poor baffling
 - high suspended solids in effluent
 - solids deposits in chlorine contact chamber
 - inadequate contact time
 - all of the above
70. Septicity in oxidation pond may be controlled by:
- hydrogen peroxide
 - sodium chloride
 - sodium nitrate
 - all of the above
 - a and b
 - a and c

71. A sludge line should never be isolated by closing valves on each end for several days because:
- the valves will rust shut
 - gas may produce enough pressure to rupture the line
 - the digester will get upset
 - gas production will cease
 - all of the above
72. What is true?
- A sludge drying bed should be filled to the top.
 - When sludge dries on a bed, add more sludge until an 8" cake is achieved.
 - Allow weeds and grass to grow as, they hasten drying.
 - Remove all dried sludge from a bed before drawing sludge.
 - Never waste more than 2" of sludge to a bed.
73. What statement is most often correct?
- The most commonly used filters for sludge dewatering are belt presses.
 - "Elutriate" is the brand name of the most commonly used belt press filter for sludge.
 - Chemical coagulants and polymers must frequently be used when dewatering a sludge with belt presses, but are not used with centrifuges because a centrifuge is a physical process.
 - The decant or liquid centrate from sludge centrifuges may contain dissolved fixed solids, but will have no more than 5 to 10 mg/l of dissolved volatile matter because of the rapid absorption in the centrifugal force field.
 - The "cake" or dewatered solids from belt press filtered digested sludge is usually about 65% to 75% solids, of which 15% to 20% is volatile.
74. Which chemical may be used to reduce drying time of sludges on beds:
- polymers
 - chlorine
 - sodium nitrate
 - hydrogen peroxide
75. In the event of a leak in a chlorine cylinder, you should be ready to, among other things:
- run, because nothing is going to help if you stay around anyway
 - turn a hose on the leak so the water will pick up the gas in solution
 - summon any available help, use a chlorine cylinder repair kit, and notify the supplier
 - move the cylinder outside and open the cylinder valve wide open to relieve the pressure so the cylinder won't explode
 - issue gas masks and asbestos hoods to all people in the region of the plant so they will be safe

76. An activated sludge plant treating municipal sewage should normally achieve which of the following minimum effluent qualities?
- 2 to 5 mg/l BOD, 40 to 60 mg/l suspended solids, less than 2 coliforms/100 ml
 - 30 to 50 mg/l BOD, 2 to 5 mg/l suspended solids, less than 200 coliforms/100 ml
 - 10 to 30 mg/l BOD, 5 to 30 mg/l suspended solids, less than 200 coliforms/100 ml
 - 10 to 30 mg/l BOD, 40 to 60 mg/l suspended solids, less than 2 coliforms/100 ml
 - 30 to 50 mg/l BOD, 5 to 30 mg/l suspended solids, less than 20,000 coliform/100 ml
77. The major problem with a lot of floating mats on a pond is:
- odors
 - insect habitat
 - turtle breeding
 - reduced sunlight
 - hinders fishing
78. The effluent weir of settling tanks should be level in order to prevent:
- short circuiting
 - clogging of the "v" notch
 - filter flies from breeding
 - scum accumulation by the weir
 - weir corrosion
79. When preparing acid solutions:
- always add the light water to the heavy acid to avoid splashing acid
 - always add the heavy acid to the light water so it can sink and dissipate heat throughout a larger volume
 - always add the water to the acid so that water vapor (steam) can escape without needed to bubble up through the acid
 - always blow directly on the acid surface as the water is added to prevent boiling
 - pour as rapidly as possible to avoid prolonged nitrogen entrainment from the air, because the combination of nitrogen, oxygen and hydrogen will react to form nitric acid fumes
80. A self-contained breathing apparatus for chlorine:
- should be stored near the floor in the room for chlorine cylinder storage so they will be cool and thus avoid rubber deterioration
 - should never be removed from their shipping containers until actually needed to avoid any possible damage or malfunction
 - should be carried at all times by the shift foreman so that he can respond to emergency leaks
 - should be stored outside of the chlorine storage and chlorine feeder rooms
 - should be left in the tool room where the equipment maintenance man can grab it whenever he must respond to a chlorine leak emergency call

81. A sludge bed is 44 ft. wide by 75 ft. long. If the bed is filled 8 in. deep with sludge, how many cubic feet of sludge will be wasted?
82. How many acres of surface area are contained in a pond 250 ft. x 400 ft.?
83. Your wetwell is 10 ft. in diameter. With one pump running it takes ten minutes to drop the level 5 feet. If no waste entered the well when the pump ran, what was the capacity of the pump in gpm?
84. It takes dye 2 minutes to travel from one manhole to another. What is the velocity if the points are 300 ft. apart? Is the velocity acceptable?
85. The rotameter on your chlorine cylinder indicates you are feeding 66 lbs./day of chlorine. If the average plant flow is 953,000 gpd, what is the chlorine feed rate in mg/l?
86. Your plant receives 210 mg/l of BOD, the effluent is 30 mg/l, and the primary clarifier removes 60 mg/l. What is the primary clarifier removal efficiency?

87. The Cherry Hill Wastewater plant receives an average flow of .377 MGD. What is the detention time in a primary clarifier that is 30 ft. x 14 ft. x 8 ft. deep in hours?
88. A stabilization pond is 300 ft. long and 200 ft. wide and has an average liquid depth of 4-1/2 feet. The pond receives an average flow of 30,000 gallons a day with an influent BOD concentration of 180 mg/l. What is the pond loading in pounds per day per surface acre?
89. Your supervisor requests that you purchase 10 cubic yards of concrete. The concrete supplier informs you that the cost per cubic yard of concrete is usually \$62.00; however, your works is entitled to a 5% discount at this price. Exclusive of any taxes, what will the 10 cubic yards cost?
90. Your gross pay is \$1,280.00 a month based on 21 work days. You missed two days work this month that will be deducted from your gross pay. What should your gross pay be?
91. The primary clarifier influent BOD is 175 mg/l and the clarifier removes 50 mg/l of BOD. What is the primary clarifier's percentage BOD removal?
92. The Madison Wastewater plant has two clarifiers each 43 ft. in diameter. They are 11 ft. deep with 9 in. of freeboard. Calculate the total clarifier volume of this plant in gallons. What is the surface area of each clarifier in sq. ft.?

93. A works chlorine residual is 0.7 mg/l and the chlorine demand is 15 mg/l. If the flow is 0.4 mgd, how many pounds of chlorine gas were fed that day?
94. Convert 1,250 gpm to mgd.
95. Convert 4 mgd to cfs.
96. Convert 3.82 cfs to mgd.
97. A wastewater works receives 180 mg/l of influent BOD, which equals 600 pounds of BOD. Express the flow in mgd to provide the above concentration and quantity.
98. The thermometer in your sample refrigerator reads 43°F. Convert to centigrade.
99. A fecal coliform incubator's water temperature is 44.5°C. Convert this to Fahrenheit.
100. Calculate the liquid volume in gallons of a clarifier with the following dimensions:
- L = 52 ft.
 - W = 18 ft.
 - D = 12 ft.
 - Freeboard = 12 in.

101. In order to evaluate the primary clarifiers at your plant a settleable solids test is run. Based on the results below what is the efficiency of the clarifiers?

Raw waste settleable solids	14 ml/l
Primary clarifier effluent settleable solids	0.6 ml/l

102. 88,000 gal of sludge are to be dewatered by adding polymer. If 1.6 lbs of polymer are used what is the dose rate in ppm?

103. The flow meter on the Parshall flume at your plant is reading 0.675 MGD. However, a compliance inspector correctly measures the flow at 0.775 MGD. What is the percent error on your flow meter?

CLASS I REVIEW ANSWERS

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|-------|--------------------|-----------------|
| 1. C | 50. B | 98. 6.1°C |
| 2. B | 51. A | 99. 112.1°F |
| 3. D | 52. B | 100. 77,014 gal |
| 4. D | 53. E | 101. 95.7% |
| 5. B | 54. B | 102. 2.18 lbs |
| 6. C | 55. A | 103. 12.9% |
| 7. C | 56. B | |
| 8. A | 57. D | |
| 9. C | 58. C | |
| 10. C | 59. A | |
| 11. C | 60. D | |
| 12. D | 61. A | |
| 13. B | 62. E | |
| 14. A | 63. B | |
| 15. A | 64. A | |
| 16. A | 65. E | |
| 17. D | 66. B | |
| 18. C | 67. B | |
| 19. C | 68. D | |
| 20. A | 69. E | |
| 21. B | 70. F | |
| 22. A | 71. B | |
| 23. D | 72. D | |
| 24. G | 73. A | |
| 25. D | 74. A | |
| 26. A | 75. C | |
| 27. D | 76. C | |
| 28. D | 77. D | |
| 29. D | 78. A | |
| 30. A | 79. B | |
| 31. E | 80. D | |
| 32. G | 81. 2197.8 cu. ft. | |
| 33. B | 82. 2.3 acres | |
| 34. D | 83. 293.5 GPM | |
| 35. B | 84. 2.5 FPS yes | |
| 36. F | 85. 8.3 mg/l | |
| 37. B | 86. 28.57% | |
| 38. E | 87. 1.6 hrs. | |
| 39. D | 88. 32.67 lbs/d/ac | |
| 40. D | 89. \$589.00 | |
| 41. E | 90. \$1158.10 | |
| 42. D | 91. 28.57% | |
| 43. B | 92. 222,568 gal | |
| 44. D | 1,451.5 sq. ft. | |
| 45. A | 93. 52.36 pounds | |
| 46. A | 94. 1.8 mgd | |
| 47. D | 95. 6.18 cfs | |
| 48. C | 96. 2.47 mgd | |
| 49. D | 97. .399 mgd | |