

Update to Wastewater Questions

Name: _____

Date: _____ Period: _____

1. HTH stands for
 - (A) Hyper Thymine Hypochlorite
 - (B) Hypochlorite Tablet Holder
 - (C) High Test Hypochlorite
 - (D) High sTrengh Hypochlorite
2. In an enhanced biological phosphorus removal system, where will the liquid phase phosphorus concentration be highest?
 - (A) Anoxic zone
 - (B) Anaerobic zone
 - (C) Aerobic zone
 - (D) Clarifier blanket
3. Phosphorus concentrations are highest in the anaerobic zone of an EBPR process. This is due to:
 - (A) Cellular breakdown of PAOs in the anaerobic zone
 - (B) Phosphorus release during uptake of VFAs
 - (C) Competition with heterotrophic bacteria stresses PAOs into releasing phosphorus
 - (D) Phosphorus released in RAS being returned to the anaerobic zone
4. PS10. Total dynamic head is the sum of the static head and
 - (A) All of these are correct.
 - (B) Suction head
 - (C) Head losses within the discharge pipeline due to friction
 - (D) Discharge head
5. The chlorinator should be kept clean and dry to avoid this potential problem
 - (A) Explosion of gas cylinder
 - (B) Formation of hydrochloric acid
 - (C) Backsiphonage of water into the cylinder
 - (D) Freezing up of withdrawal mechanism
6. What is the typical organic loading rate for a well mixed and heated anaerobic digester in pounds of volatile solids per cubic foot per day?
 - (A) 0.1 - 0.4
 - (B) 0.05 - 0.10
 - (C) 0.4 - 0.8
 - (D) 0.8 - 1.2
7. One reason that air should be excluded from anaerobic digesters is because
 - (A) Gas storage capacity is reduced
 - (B) Air mixed with gas produced in the digester could create an explosive combination
 - (C) Air interferes with aerobic bacteria action
 - (D) Harmful or pathogenic bacteria may be introduced with air
 - (E) None of these answers are correct
8. When sodium hypochlorite is added to water, the pH
 - (A) Remains the same
 - (B) Decreases
 - (C) Who cares?
 - (D) Increases
9. A digester operated in a temperature range of 115-125 degrees F is in the _____ range
 - (A) Phsycrophilic
 - (B) Homeopathic
 - (C) Thermophilic
 - (D) Mesophilic

10. For healthy methane forming micro-organisms in an anaerobic digester, the pH should be maintained between:
- (A) 7-9
 - (B) 6-8
 - (C) 7-8
11. As water temperature increases, chlorine gas solubility
- (A) Remains the same
 - (B) Increases
 - (C) Decreases
12. The two major gasses found in digester gas are _____ and _____.
- (A) Nitrogen and Carbon dioxide
 - (B) Methane and Carbon dioxide
 - (C) Nitrogen and Methane
 - (D) Methane and Carbon monoxide
13. Two criteria determine a digester's capacity: the hydraulic detention time and the _____ loading rate
- (A) Biological Oxygen Demand (BOD)
 - (B) Total solids (TS)
 - (C) Polymer
 - (D) Volatile suspended solids (VSS)
14. A chlorine cylinder is delivered to a treatment plant. The cylinder appears normal and does not have any obvious dents. The operator places his hand on the cylinder and it is hot to the touch. He should
- (A) Do nothing. The cylinder is probably hot from riding in the back of the truck all day.
 - (B) Make a note and notify a supervisor.
 - (C) Weigh the cylinder to ensure it is full before placing it in the rack.
 - (D) Reject the cylinder. A hot cylinder could indicate internal moisture contamination
15. Digester heat requirements include: heat required to _____ the temperature of incoming feed sludge to the operating temperature, and heat required to _____ the digester operating temperature.
- (A) Maintain, raise
 - (B) Lower, maintain
 - (C) Maintain, mix
 - (D) Raise, maintain
16. What is the maximum number of pounds of chlorine that may be safely withdrawn from a 150 pound cylinder in one day?
- (A) 40
 - (B) 60
 - (C) 400
 - (D) 200
17. Can a chlorine gas cylinder repair kit be used to repair a sulfur dioxide cylinder leak?
- (A) Yes, but different washers will be needed
 - (B) Yes, of course, the repair kits are interchangeable
 - (C) No, the sulfur dioxide cylinder needs a different repair kit
 - (D) No, sulfur dioxide is not a gas and doesn't come in cylinders
18. Phosphorus accumulating organisms (PAOs) use readily available substrate in the anaerobic zone to do which of the following?
- (A) Grow
 - (B) Gain energy
 - (C) Convert to internal storage products
 - (D) Reduce phosphorus
19. PS1. This type of pump is installed inside a wet well.
- (A) Submersible
 - (B) Positive displacement
 - (C) Centrifugal
 - (D) Piston

20. An anaerobic zone designed for biological phosphorus removal will typically have a hydraulic retention time of
 (A) 45 minutes or less
 (B) 1 to 3 hours
 (C) 20 percent of the total HRT
 (D) 4 to 6 hours
21. An operator collects samples for his monthly DMR. The final effluent contains 15 mg/L of TSS and 17 mg/L of BOD. If the MLSS contains 8 percent P, what is the effluent P concentration? Assume no soluble P is present.
 (A) 1.36 mg/L
 (B) 1.20 mg/L
 (C) 2.56 mg/L
 (D) <1.0 mg/L
22. As water temperature decreases, the amount of chlorine gas that can be dissolved in the wastewater
 (A) Decreases
 (B) Remains the same
 (C) Increases
23. This sulfite salt is the least expensive and most stable alternative for disinfection
 (A) Sulfur dioxide
 (B) Sodium metabisulfite
 (C) Sodium bisulfite
 (D) Sodium sulfite
24. Solids stabilization in the anaerobic digestion process is accomplished during which stage?
 (A) Acid formation
 (B) Solids draw off
 (C) Supernatant removal
 (D) Volatile acid reduction
 (E) Time on drying beds
25. Which of the following is not an example of a sludge stabilization method?
 (A) Lime
 (B) Composting
 (C) Drying beds
 (D) Heat drying
 (E) Digestion
26. PS16. Wet well sizes must be large enough to minimize _____ but small enough to _____.
 (A) Pump cycles per hour / maximize release of toxic gasses
 (B) Overflow of raw sewage / minimize hydrogen sulfide generation
 (C) The pump size required / minimize the accumulation of solids in the wet well
 (D) Pump cycles per hour / minimize the accumulation of solids in the wet well
27. If the influent BOD concentration decreases and the influent phosphorus concentration remains the same, what is the expected impact at the final effluent?
 (A) Potentially higher effluent P concentrations
 (B) Formation of struvite crystals in anoxic zone
 (C) Higher concentration of P in MLSS
 (D) Increased oxygen demand in aeration basin
28. Total phosphate includes these forms:
 (A) Orthophosphate and Polyphosphate
 (B) Orthophosphate, Organically Bound Phosphate, and Condensed Phosphate
 (C) Polyphosphate, Long-chain Phosphate, and Orthophosphate
 (D) Organically Bound Phosphate and Inorganic Phosphate
29. Chlorine gas is this color
 (A) Colorless
 (B) Bright green
 (C) Greenish yellow
 (D) Clear amber

30. When chlorine gas is added to water, the pH
- (A) Remains the same
 - (B) Drops 0.5 pH units on average
 - (C) Decreases
 - (D) Increases
31. This law governs reporting requirements for treatment facilities using chlorine gas
- (A) Superfund Amendments and Reauthorization Act
 - (B) Emergency Planning and Community Right to Know Act
 - (C) SARA Title IIA
 - (D) National Fire Protection Act (NFPA) Title 20
32. If chlorine gas is withdrawn from an 150 lb cylinder faster than 40 pounds per day, what is the probable outcome?
- (A) Cylinder will freeze making further withdrawals impossible
 - (B) Operator will be written up for wasting chlorine
 - (C) O-rings around outlet area may be degraded
 - (D) Ejector may be damaged and require replacement
33. Liquid chlorine should never be allowed to contact skin for this reason
- (A) Chlorine reacts with sweat to form hydrochloric acid
 - (B) Liquid chlorine is extremely corrosive
 - (C) Chemical frost bite can occur
 - (D) The sudden pH increase can cause chemical burns
34. Liquid chlorine will yield this many volumes of gas when pressure is released
- (A) 728
 - (B) 82
 - (C) 456
 - (D) 200
35. Fusible plugs are designed to melt at this temperature to prevent hydrostatic rupture of the cylinder or container
- (A) 158 - 164 degrees F
 - (B) 148 - 154 degrees C
 - (C) 90 - 120 degrees C
 - (D) 180 - 212 degrees F
36. In lime stabilization of sludge the goal is to raise the pH to what level and hold it there for 2 hours?
- (A) pH 5
 - (B) pH 12
 - (C) pH 8
 - (D) pH 10
37. The purpose of disinfection is to
- (A) Destroy or inactivate pathogens to very low levels
 - (B) Meet the requirements of the discharge permit
 - (C) Completely eliminate all pathogens
 - (D) Sterilize the water or wastewater
38. For enhanced biological phosphorus removal to take place, the phosphate accumulating organisms must be cycled between these conditions
- (A) Anoxic and aerobic
 - (B) Fermentation and Anaerobic
 - (C) Anaerobic and aerobic
 - (D) Anaerobic, anoxic, aerobic
39. PS14. Calculate the total time per pump cycle (pump on to pump on) in minutes. The wet well is 20 feet square. The low level water level is 2 feet and the high water level is 12 feet. Water is entering the lift station at a rate of 200 gpm. The lead pump is capable of pumping 500 gpm.
- (A) 25 minutes
 - (B) 100 minutes
 - (C) 50 minutes
 - (D) 200 minutes

40. PS12. Cavitation may be caused by all of these things EXCEPT
- (A) Restrictions in the suction line
 - (B) Air leaks on the suction side of the pump
 - (C) Excessive tip speed of the impeller
 - (D) Entrained solids
41. The standard percent efficiency equation cannot be used to calculate volatile suspended solids reduction in a digester. Why not?
- (A) Inert materials pass through the digester unchanged. The VSS reduction equation accounts for this phenomenon.
 - (B) Biosolids are converted to carbon dioxide gas which can't be measured.
 - (C) The hazardous atmosphere in an anaerobic digester makes obtaining the samples needed for the percent efficiency equation too dangerous
 - (D) Because we've always done it this way
42. The mechanism used to remove dewatered sludge from the belt of a belt filter press is commonly referred to as a(n)
- (A) Doctor blade
 - (B) Pressure belt
 - (C) Edge sensor
 - (D) Scum collector
43. What is the IDLH (Immediately Dangerous to Life or Health) concentration for chlorine?
- (A) 200 ppm
 - (B) 1 ppm
 - (C) 30 ppm
 - (D) 500 ppm
44. Phosphate accumulating organisms (PAOs) store large quantities of phosphorus for this reason
- (A) Food source
 - (B) Energy storage
 - (C) Ion release
 - (D) Maintain electrolytic balance
45. When opening the valve on a chlorine cylinder, how far should it be turned?
- (A) Until gas reaches the ejector
 - (B) Full open
 - (C) 1/4 turn
 - (D) 1/2 turn
46. Precipitation of magnesium ammonium phosphate in a digester is called _____.
- (A) Calcite
 - (B) Struvite
 - (C) Bauxite
 - (D) Stalactite
47. During biological phosphorus removal, what takes place in the aerobic zone?
- (A) Luxury uptake of phosphorus and consumption of poly-B-hydroxybutarate
 - (B) Release of phosphorus and storage of glycogen
 - (C) Release of phosphorus, sodium, and potassium
 - (D) Uptake of phosphorus and consumption of glycogen
 - (E) Release of phosphorus and uptake of VFAs
48. PS4. Air and vacuum release valves may not function properly if this is allowed to happen
- (A) Pressure in force main exceeds 15 psi
 - (B) Grease accumulation in valve body or operating mechanism
 - (C) Valve seat contaminated with grit
 - (D) Vacuum in force main exceeds -2.4 torr
49. What is the Permissible Exposure Limit (PEL) for chlorine gas?
- (A) 1.0 ppm
 - (B) 5 ppm
 - (C) 0.5ppm
 - (D) 30 ppm

50. PS4. Air and vacuum release valves can be cleaned this way
 (A) Disassemble and soak in muriatic acid
 (B) Backflushing with clean water
 (C) Forcing pressurized air through operating mechanism
 (D) Sanding with a mild abrasive like Comet
51. The Occupational Safety and Health Administration (OSHA) has set the PEL limit for chlorine at 0.5 ppm as an 8 hour average. OSHA further stipulates that the chlorine concentration may not exceed _____ at any time.
 (A) 500 ppm
 (B) 5 ppm
 (C) 30 ppm
 (D) 1 ppm
52. For chlorine disinfection to be effective, the minimum contact time should be
 (A) 30 minutes
 (B) 90 minutes
 (C) 60 minutes
 (D) 10 minutes
53. An operator enters a chlorine gas room. The smell of chlorine is very strong. The operator determines that chlorine gas is leaking from a 1 ton container. Which repair kit will they need?
 (A) C
 (B) B
 (C) D
 (D) A
54. Chlorine gas is detectable by most people at these concentrations because of its distinctive odor
 (A) 0.02 to 0.2 ppm
 (B) 1.0 to 2.5 ppm
 (C) 5.2 to 7.3 mg/L
 (D) 1.0 to 2.5 ppb
55. Which gas produced in anaerobic digesters can be used as fuel?
 (A) Methane
 (B) Propane
 (C) Carbon dioxide
 (D) Ethane
56. Which one of these is an indicator of good enhanced EBPR performance?
 (A) Negative oxidation-reduction potential readings in anoxic zone
 (B) High phosphorus content of mixed liquor
 (C) Low BOD concentration in effluent
 (D) Increased oxygen consumption in aerobic zone
57. PS17. Aluminum should not come into direct contact with concrete. If it does, this will happen
 (A) Localized softening of the concrete due to a chemical reaction
 (B) Corrosion of the aluminum
 (C) Sparking
 (D) Accumulation of hydrogen sulfide crystals at the contact point
58. The amount of contact time required for chlorine disinfection _____ as pH increases.
 (A) Decreases
 (B) Increases
 (C) Remains the same
59. PS2. Install one of these devices at the highest point in a force main to get entrained air out of the system.
 (A) Air release valve
 (B) Vacuum release valve
 (C) Backflow preventer
 (D) Inverted siphon

60. As temperatures increase, the efficiency of chlorine disinfection
- (A) Remains the same
 - (B) Decreases
 - (C) Increases
61. If a chlorine leak is suspected, it can be located by using
- (A) A certified nose
 - (B) A chlorine detection monitor
 - (C) A rag soaked in 20 Baume ammonia solution
 - (D) A squirt bottle containing 10 Baume ammonia solution
62. One disadvantage of using sodium hypochlorite for disinfection is that it degrades over time. Sodium hypochlorite solution should be used within this many days to ensure potency.
- (A) 90
 - (B) 60
 - (C) 120
 - (D) 30
63. If the influent wastewater ratio of BOD:P is less than 20, how can phosphorus removal efficiency be improved?
- (A) Increase hydraulic residence time in anaerobic zone
 - (B) Addition of VFAs to anaerobic zone
 - (C) Addition of phosphorus to anaerobic zone
 - (D) Allow nitrate to bleed into anaerobic zone
64. What is affected first when the anaerobic digestion process is starting to deteriorate?
- (A) Supernatant quality
 - (B) Volatile acid:alkalinity ratio
 - (C) Volatile solids concentration
 - (D) Temperature
65. A chlorine gas ejector operates on this principal
- (A) Suction
 - (B) Pressure
 - (C) Vacuum
 - (D) Saturation
66. Which mechanical dewatering device consists of a: polymer conditioning zone, gravity drainage zone, low-pressure zone, and high pressure zone?
- (A) Belt filter press
 - (B) Vacuum filter
 - (C) Solid bowl centrifuge
 - (D) Bowl centrifuge
67. In an anaerobic digester, gas production should be in the vicinity of ___ cu.ft per of gas/day per lb. of volatile matter destroyed.
- (A) 12
 - (B) 8
 - (C) 15
 - (D) 10
68. Chlorine dose is always equal to
- (A) The measured residual chlorine
 - (B) Residual plus demand
 - (C) Demand minus residual
 - (D) The measured free chlorine
 - (E) The chlorinator setting less the residual
69. The exhaust vents is a chlorine gas room should be located here
- (A) Near the floor
 - (B) At the ceiling
 - (C) As close to the cylinders as possible
 - (D) Wherever they won't be in the way
70. What is the most important factor when conditioning solids for dewatering?
- (A) Filamentous bacteria
 - (B) Particle size
 - (C) Nitrification
 - (D) Sludge temperature

71. During biological phosphorus removal, what takes place in the anaerobic zone?
 (A) Uptake of phosphorus and consumption of glycogen
 (B) Release of phosphorus and uptake of VFAs
 (C) Release of phosphorus, sodium, and potassium
 (D) Release of phosphorus and storage of glycogen
 (E) Uptake of phosphorus and consumption of poly-B-hydroxybutarate
72. PS18. The largest diameter waste that should ever be present in a wastewater pump station is _____. This is the largest diameter sphere that can pass through most home toilets and disposal systems.
 (A) 7.5 inch
 (B) 1.5 inch
 (C) 2.5 inch
 (D) 5.0 inch
73. What is the minimum ratio of BOD:P required to ensure that an Enhanced Biological Phosphorus Removal (EBPR) process removes phosphorus to concentrations less than 1.0 mg/L in the final effluent?
 (A) 100
 (B) 45
 (C) 20
 (D) 333
74. Final effluent phosphorus concentrations must be reported as PO₄ on the discharge monitoring report. When the lab results come back, they are reported as 2.3 mg/L P. What concentration should be reported on the DMR?
 (A) 7.06 mg/L PO₄
 (B) 2.3 mg/L PO₄
 (C) 2.3 mg/L P
 (D) 6.85 mg/L PO₄
75. The devices that set the minimum operating level on a floating cover are called _____.
 (A) Corbels
 (B) Level indicators
 (C) Lift Brackets
 (D) Stress pins
76. A well established anaerobic digester has a total alkalinity of
 (A) 3000 - 4000mg/L
 (B) 2000 - 5000mg/L
 (C) 50 - 300mg/L
 (D) 50 - 700mg/l
77. The 3 types of digester covers are:
 (A) Open
 (B) Gas holding
 (C) Fixed
 (D) Bolted
 (E) Floating
 (F) Gas releasing
78. Chlorine gas is heavier than air. How much heavier?
 (A) 35 percent
 (B) 2.5 times
 (C) 20 percent
 (D) 5 times
79. The Occupational Health and Safety Administration (OSHA) set the PEL for chlorine at 0.5 ppm. This is the concentration
 (A) Safe for MAXIMUM exposure concentration for two hours of an 8 hour workday
 (B) Acceptable inside gas cylinder storage rooms
 (C) Requiring Personal Protective Equipment (PPE) such as respirators
 (D) Safe for AVERAGE exposure concentration during an 8 hour workday
80. Chloramines are formed when chlorine reacts with this compound
 (A) Amyl Nitrile
 (B) Amino acids
 (C) Ammonia
 (D) Amylase

81. PS15. A wet well is 8 ft diameter. The low level water level is 2 feet and the high water level is 10 feet. Water is entering the lift station at a rate of 10 gpm. If the maximum number of pump on/off cycles per hour desired is 3, what capacity pump should be installed? Express your answer in gpm.
- (A) 70 gpm
 - (B) 290 gpm
 - (C) 160 gpm
 - (D) 450 gpm
82. For "vector attraction reduction," the new sludge rules require a ___ reduction in volatile solids across a digester process before land application.
- (A) 40%
 - (B) 35%
 - (C) 32%
 - (D) 38%
83. Anaerobic digesters are generally operated at a temperature of about ___ deg. C. The bacteria that prefer this temperature are referred to as _____.
- (A) 95, facultative
 - (B) 35, mesophilic
 - (C) 35, thermophilic
 - (D) 95, thermophilic
84. PS3. If air release valves are not installed at the high points of force mains, this condition may result.
- (A) Pipe breakage
 - (B) Cavitation
 - (C) Water hammer
 - (D) Crown corrosion throughout forcemain
85. A one ton cylinder has this many fusible plugs
- (A) Three, spaced at 40 degree intervals on one end
 - (B) Five, two on each end and one in the middle
 - (C) One, located at the gas withdrawal line attachment point
 - (D) Six, three at each end
86. Which polymer has an ionic charge that may vary with the pH of the solids being conditioned?
- (A) Anionic
 - (B) Polyelectrolyte
 - (C) Nonionic
 - (D) Cationic
87. Chlorine may be safely stored with
- (A) Organic compounds
 - (B) Oils and Solvents
 - (C) Greasy machinery
 - (D) None of the above
88. The liquid between the sludge on the bottom and the scum on the top of a non-mixed digester is called _____.
- (A) Subnatant
 - (B) Decant
 - (C) Supernatant
 - (D) Interstitial layer
89. In a gravity thickener gravitational forces are used to thicken solids. What forces are used by a centrifuge?
- (A) Sedimentation forces
 - (B) Gravitational forces
 - (C) Centrifugal forces
 - (D) Mechanical pressure forces
90. Typical volatile acids concentrations in a anaerobic digester range from:
- (A) 2000-5000mg/L
 - (B) 50-300mg/L
 - (C) 50-700mg/l
 - (D) 3000-4000mg/L

91. In 2001, EPA promulgated the Extremely Hazardous Substances (EHS) list under EPCRA (Emergency Planning and Community Right to Know Act). Under this legislation, what is the reportable quantity of chlorine gas?

- (A) 1,500 pounds
- (B) 100 pounds
- (C) 500 pounds
- (D) 10,000 pounds

Update to Wastewater Questions

Answer Key

1. C
2. B
3. B
4. C
5. B
6. A
7. B
8. D
9. C
10. B
11. C
12. B
13. D
14. D
15. D
16. A
17. A
18. C
19. A
20. A
21. B
22. C
23. B
24. D
25. C
26. D
27. A
28. B
29. C
30. C

- 31. B
- 32. A
- 33. C
- 34. C
- 35. A
- 36. B
- 37. A
- 38. C
- 39. B
- 40. D
- 41. A
- 42. A
- 43. C
- 44. B
- 45. C
- 46. B
- 47. A
- 48. B
- 49. C
- 50. B
- 51. D
- 52. A
- 53. B
- 54. A
- 55. A
- 56. B
- 57. B
- 58. B
- 59. A
- 60. C
- 61. C
- 62. B
- 63. B
- 64. B
- 65. C

- 66. A
- 67. A
- 68. B
- 69. A
- 70. B
- 71. B
- 72. C
- 73. C
- 74. A
- 75. A
- 76. B
- 77. B, C, E
- 78. B
- 79. D
- 80. C
- 81. C
- 82. D
- 83. B
- 84. C
- 85. D
- 86. C
- 87. D
- 88. C
- 89. C
- 90. B
- 91. B