

ADEQ

Arizona Department
of Environmental Quality



WATER PDH WORKBOOK

Completion of this workbook will count for 5 PDHs

Arizona Department of Environmental Quality
Drinking Water Section-Programs Unit
Operator Certification Program
1110 West Washington Street
Phoenix, AZ 85007
www.azdeq.gov

NAME _____

OPCERT NUMBER OPO _____

DATE _____

DIRECTIONS

Answer the questions in the space provided with concise and accurate answers. Submit a copy of the completed workbook along with your renewal form when you renew your certificates. It is recommended that you keep a copy of the completed booklet for your records. Completion of this workbook will earn the operator five (5) PDHs. Please print clearly. Workbooks that are illegible will not receive PDHs.

PDH means professional development hour.

A professional development hour is equal to one contact hour of continuing education. A total of 30 professional development hours are required for each 3-year renewal period regardless of the number of certificates that are held by an individual operator. Ten of the thirty PDHs must be directly related to an operator's job.

The type of PDH acceptable to the Department for certificate renewal include, but are not limited to: an approved college course, a course offered by a Certified Environmental Trainer, regulatory and tribal agency training, certain types of in-house training, technical conferences, correspondence courses, and manufacturer product training. An accredited college course is usually recorded in credit hours. In general, 1 college credit hour = 10 PDHs. If an operator has a question about a specific type of training, please contact the Operator Certification Program for approval before attending the training.

For additional training/PDHs click on the link below. This course provides 16 hours of PDH-approved training for drinking-water operators in the State of Arizona. These are available as individual lessons for credit or as a whole course.

<http://www.waterhelp.org/index.php/client/arizona>

FOR MORE INFORMATION, CONTACT:

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Operator Certification Outreach
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1. List four infectious diseases that can be transmitted in water.

2. What are the limitations of UV disinfection?

3. Define breakpoint

4. When chlorine is added to water, it breaks down into two products. Name them

5. Define chlorine residual

6. Why is chlorine less effective at higher pH?

7. What is the difference between disinfection and sterilization?

8. Describe chlorine gas and its health effects

9. What function does the injector serve?

10. Explain the significance of water containing total coliform

11. List four other uses of chlorine besides disinfection of portable water

1) _____

2) _____

3) _____

4) _____

12. What organism is measured to determine the effectiveness of disinfection? Why?

13. What is a pathogen?

14. List 8 reasons for providing water storage in a distribution system

- ---
- ---
- ---
- ---
- ---
- ---
- ---
- ---

15. List the 4 types of distribution storage tanks and describe each of them

- ---
- ---
- ---
- ---

16. What is the difference between operating storage and emergency storage?

17. What is the purpose of an altitude valve?

18. Why should vent openings on storage tanks be screened?

19. After disinfection, what must be done before a tank is put back in service?

20. Name three things that should be considered when determining the type and the site for a new storage tank

- _____
- _____
- _____

21. Why should the overflow pipe on a storage tank never be directly connected to a sewer or storm drain?

22. How are storage tanks protected from corrosion?

23. An aquifer is _____.

- A. a bottle of water
- B. an underground layer of porous, water material
- C. an above ground storage facility
- D. a deep water well

24. Groundwater is _____ to clean up pollutants than surface water.

- A. easier
- B. less costly
- C. quicker
- D. harder

25. The main operating unit in a centrifugal pump is _____.
- A. foot valve
 - B. impeller
 - C. volute
 - D. diaphragm
26. A pitless adaptor refers to _____.
- A. an attachment to the well casing to provide a sanitary seal between the well casing and the effluent line
 - B. a device that allows a well to be pumped from without actually digging a well pit
 - C. a view tube that allows a visual contact to the well for inspection purposes
 - D. an adaptor that allows for the changing of pipe diameters without re-drilling of the bore hole
27. Subsidence as it relates to groundwater is defined as _____.
- A. a level at which the chlorine demand is satisfied
 - B. the sinking of land resulting from groundwater extraction
 - C. an underground water-bearing area with enough capacity to satisfy demand
 - D. a subsidy granted from the EPA to small groundwater systems
28. Why do we monitor for nitrates? _____
- A. pathogens
 - B. cryptosporidium
 - C. methelomoglobinemia (blue baby syndrome)
 - D. fecal coliform
29. The principle scale forming substance in water is _____.
- A. calcium carbonate
 - B. tuberculation
 - C. manganese
 - D. magnesium
30. MCL is an acronym for? _____
- A. Maximum Coliform Level
 - B. Majority Contaminants Labeled
 - C. Maximum Contaminant Level
 - D. Minimum Cryptosporidium Level

31. Lead and Copper samples should be _____.

- A. taken quarterly
- B. stored in a cool dry place for eight hours
- C. taken at the entrance to the distribution system
- D. taken at the customer tap

32. A pH value of _____ is considered neutral.

- A. 3
- B. 6
- C. 7
- D. 9

33. Hydrogen sulfide smells like?

34. A disease causing organism is called _____.

- A. a bacteria
- B. a parvum
- C. an Oocyst
- D. a pathogen

35. Which word does **not** describe a term in the hydrological cycle?

- A. participation
- B. condensation
- C. runoff
- D. precipitation

36. Water consumption in a municipality that uses ammeters as opposed to flat billing, the water usage would _____.

- A. water usage would be higher
- B. water usage would be lower
- C. water usage wouldn't change
- D. no definitive answer on way or another

37. A physical link between a potable water supply and one of unknown or questionable quality is _____.

- A. backisphonage
- B. backpressure
- C. air gap
- D. cross connection

38. Chemical reactions take place more rapidly in _____ water.

- A. colder
- B. turbid
- C. warmer
- D. cloudy

39. Calcium hypochlorite does **NOT** come in which form? _____

- A. tablet
- B. powder
- C. gas
- D. granular

40. Coliforms are

- A. pathogenic
- B. indicator organisms
- C. lethal
- D. toxic

41. The most important duty of a water treatment operator is _____.

- A. to get promoted as often as possible
- B. follow the mayor's directives explicitly
- C. get away with as much as possible
- D. protect the public health

42. (True or False) A centrifugal pump can be started against a closed valve without damaging the pump.

43. A water system that uses chlorine as a disinfectant but fails to flush their distribution system will cause the chlorine demand to _____.

- A. increase
- B. decrease
- C. have no effect
- D. decrease over time

44. Unidirectional flushing of distribution systems require that which of these conditions to occur? _____

- A. velocities at a minimum of 2.5ft/per second
- B. begin and the source and work out the toward the far reaches of the system
- C. continue at each flushing sire until maximum disinfection level is achieved
- D. all of the above

45. What is sodium thiosulfate?

46. Which is a viable treatment technique for removing hydrogen sulfide? _____

- A. declassification
- B. aeration
- C. sedimentation
- D. fluoridation

47. Which disinfection potential is greater in _____ water and chlorine residual is more persistent in _____ water.

- A. warmer, colder
- B. colder, warmer
- C. colder, colder
- D. warmer, warmer

48. Which device provides protection against both backsiphonage and backflow?

49. Greensand filtration proceeded by potassium permanganate is an effective removal technique for _____.

- A. iron
- B. cryptosporidium
- C. lead and copper
- D. cadmium

50. The intention of adding fluoride to our drinking water is to? _____
- A. to further communism
 - B. build strong bones and teeth in children
 - C. to cause anionic polymers to clump together
 - D. to stabilize the pH of water for efficient filtration
51. What is a device used to check the flow to water consumers? _____
- A. heterotrophic plate counts
 - B. atmosphere vacuum breakers
 - C. pressure reducing valves
 - D. water meters
52. (True or False) Surface waters are more difficult to clean up (remediate) than groundwater?
- _____
53. A physical link between a potable water supply and one of unknown or questionable quality is _____.
- A. a cross connection
 - B. a Tier 1 violation
 - C. a Boil Water Advisory
 - D. a backflow prevention assembly
54. The purpose of stabilization is _____.
- A. to prevent floc from rising in the basin
 - B. to prevent sludge from entering the filters
 - C. to prevent corrosion or excessive scale from entering the distribution system
 - D. to prevent excessive turbidity at the top of the filters
55. _____ are used to cause particles to become destabilized and begin to clump together.
- A. coagulant aids
 - B. nonsetttable solids
 - C. zeta particles
 - D. primary coagulants

56. The hydrologic cycle relates to _____
- A. the treatment of processes
 - B. continuous improvement of water quality
 - C. movement of water in the environment
 - D. the moons pull on tidewaters
57. In solid contact units, the three main operational fundamentals are _____.
- A. sedimentation, slurry and suspended solids
 - B. mixing clarifying and filtration
 - C. chemical dosage, recirculation rate, and sludge control
 - D. weighing agents, alkalinity and pac
58. Particular contact can used in place of _____ in the treatment process to obtain better control.
- A. flash mixers
 - B. variable drives
 - C. filter coring
 - D. turbidimeters
59. In their soluble or reduced state iron and manganese are _____.
- A. alkalinity enhancers
 - B. colorless
 - C. negatively charged
 - D. will not dissolve in water
60. _____ corrosion is the corrosivity of dissimilar metals
- A. saline
 - B. hydroxyl
 - C. excessive
 - D. galvanic
61. During the coagulation/ flocculation process, particulate impurities can be divided into two classification.
- A. primary coagulants and coagulant aids
 - B. settleable and nonsetteable solids
 - C. hydraulic and mechanical

62. _____ polymers are positively charged.
- A. nonionic
 - B. anionic
 - C. cationic
 - D. platonic
63. Generally, the more uniform the media, the _____ the rate of headloss.
- A. slower
 - B. same
 - C. smaller
 - D. larger
64. In conventional rectangular sedimentation basins 50% of the sludge should settle out in the _____ of the basin.
- A. first third
 - B. last half
 - C. very beginning
 - D. tail end
65. The Langeliers Saturation Index provides an indication of _____.
- A. the solubility of iron and manganese
 - B. the pH necessary to settle out color
 - C. the rate at which particles will settle out
 - D. the likelihood that your source water is corrosive
66. Overdosing of potassium permanganate will likely cause _____.
- A. an extremely high pH
 - B. pink water
 - C. taste and odor
 - D. inadequate settling
67. Which of the following is most likely to be used as a primary coagulant ? _____
- A. brine
 - B. ammonium hydroxide
 - C. ferric sulfate
 - D. sodium thiosulfate

Matching terms

Parts of a Well- Matching

Select the term to its definition:

- Sanitary Seal (_____)
- Well Casing (_____)
- Intake Screen (_____)
- Grout (_____)
- Well Slab (_____)

Well Terms- Matching

Select the term to its definition:

- Static Water Level (_____)
- Pumping Water Level (_____)
- Drawdown (_____)
- Cone of Depression (_____)
- Zone of Influence (_____)
- Residual Drawdown (_____)
- Well Yield (_____)
- Specific Capacity (_____)

Definition bank

1. Allows water to flow freely from an aquifer to a well; keeps sand out of a well.
2. Concrete area placed around the casing to support pumping equipment .
3. A liner placed in the bore hole of a well to prevent the walls from caving in.
4. Prevent contamination from entering the well at the surface.
5. Seals the space between the casing and the bore hole.
6. Inverted cone-shaped depression in water level while pump is operating.
7. Water level when no water is being pumped from the aquifer.
8. Difference between original water level and the level after pumping has stopped.
9. Well yield ÷ drawdown
10. Level to which water drops and stabilizes as it is pumped.
11. Length and depth of radius of influence as determined by the cone of depression.
12. The drop between the static water level and the pumping water level
13. The rate of water withdrawal that can be supplied over a period of time.

81. Leakage of water around the packing on a centrifugal pump is important because it acts as a(n): _____

- A. adhesive
- B. lubricant
- C. absorbent
- D. backflow preventer

82. What is the purpose of wear rings in a pump? _____

- A. hold the shaft in place
- B. hold the impeller in place
- C. control amount of water leaking from discharge to suction side
- D. prevent oil from getting into the casing of the pump

83. Which of the following does a lantern ring accomplish? _____

- A. lubricates the packing
- B. helps keep air from entering the pump
- C. both (A) and (B)

84. Closed, open and semi open are types of what pump part? _____

- A. impeller
- B. shaft sleeve
- C. casing
- D. coupling

85. When tightening the packing on a centrifugal pump, which of the following applies? _____

- A. tighten hand tight, never use a wrench
- B. tighten to 20 foot pounds of pressure
- C. tighten slowly, over a period of several hours
- D. tighten until no leakage can be seen from the shaft

86. Excessive vibration in a pump can be caused by: _____

- A. bearing failure
- B. Damage to the impeller
- C. Misalignment of the pump shaft and motor
- D. all of the above

87. What component can be installed on a pump to hold the prime? _____
- A. toe valve
 - B. foot valve
 - C. prime valve
 - D. Casing valve
88. The operating temperature of a mechanical seal should not exceed: _____
- A. 140° F
 - B. 150° F
 - C. 160° F
 - D. 170° F
89. What is the term for the condition where small bubbles of vapor form and exploded against the impeller, causing a pinging sound? _____
- A. corrosion
 - B. cavitation
 - C. aeration
 - D. combustion
90. The first thing that should be done before any work is begun on a pump or electrical motor is:

- A. notify the state
 - B. put on safety goggles
 - C. lock out the power to supervise the work
 - D. have a competent person to supervise the work
91. Under what operating conditions do electric motors pull the most current? _____
- A. at start up
 - B. at full operating speed
 - C. lock out the power source and tag it
 - D. when locked out
92. Positive displacement pumps are rarely used for water distribution because: _____
- A. they require too much maintenance
 - B. they are no longer manufactured
 - C. they require constant observation
 - D. centrifugal pumps are much more efficient

93. Another name for double-suction pump is: _____

- A. double-jet pump
- B. reciprocating pump
- C. Horizontal split-case pump
- D. double-displacement

94. As the impeller on a pump becomes worn, the pump efficiency will: _____

- A. decrease
- B. increase
- C. stay the same

Math Section

95. Calculate the chlorine feed rate in lbs/day for chlorine dosage of 6 mg/l at a flow of 100,000 gal/day.

96. A chlorine contact tank with a volume of 20,000 gallons receives an average flow of 1000 gal/min. If the minimum contact time is 15 minutes, is this tank above or below the minimum time?

97. What is the chlorinator feed rate in lbs/day if the chlorine dosage is 8 mg/L and the flow is 500,000 gal/day?

98. How many pounds of HTH (65% available chlorine) are required to make 35 gallons of 5% available chlorine bleach? (Assume bleach is 8.34 lbs/gal)

99. What is the demand of your wastewater if you feeding 133 lbs/ day pf chlorine and the flow rate is 2 MGD? The chlorine residual after a 30 minutes contact time os 1.5 mg/L.

100. If the specific gravity of sodium hypochlorite solution is 1.4 how much would 3 gallons of solution weigh? _____

- A. 25.0 lbs
- B. 30.0 lbs
- C. 20.0 lbs
- D. 35.0 lbs

NAME _____

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