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 OP0_____

DATE_____

DIRECTIONS

Answer the questions in the space provided with concise and accurate answers. Mail the completed booklet to the address provided. 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/PHDs 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

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1. Define pathogenic organisms and their source in water and wastewater.

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_____
_____

2. Name the type of organism (bacteria, virus, or parasite) responsible for causing the following waterborne diseases:

A. Typhoid Fever

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_____
_____

B. Dysentery

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_____
_____

C. Cholera

_____
_____
_____

D. Salmonellosis

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_____
_____

E. Hepatitis A

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_____
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F. Giardiasis

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G. Amoebic Dysentery

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3. State the reasons for disinfecting water and wastewater, including seasonal disinfection.

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4. List the most common methods of disinfecting treated water and wastewater.

5. Explain the relationship between chlorine dosage, chlorine demand, and chlorine residual.

6. Describe conditions that affect chlorine demand.

7. Define dechlorination and the chemicals commonly used.

8. Define hypochlorination and the chemicals commonly used in this process.

9. Define the following terms:
A. Free Available Chlorine

B. Combined Available Chlorine

C. Total Chlorine Residual

10. Describe the location where chlorine should be added for disinfection.

11. Describe a typical chlorine contact tank and its purpose.

12. Discuss how a typical ultraviolet disinfection unit functions.

13. Explain the purpose of a fusible plug, and where it is located on 150 pound cylinders.

14. List the physical properties of Chlorine (Liquid and Gas) for the following:
A. Boiling Point (At Atmospheric Pressure)

B. Density

C. Specific Gravity

D. Color

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_____
_____
_____

E. Odor

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_____

F. Solubility in water

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_____
_____
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15. What are salmonella, shigella, and vibrio cholera examples of?
A. Insects
B. Bacteria
C. Viruses
D. Intestinal Parasites

16. What are the two main chemical species formed by chlorine in water and what name are they known by collectively?
A. HOCl and OCl-; free available chlorine
B. Cl2 and OCl-; breakpoint chlorine
C. Cl2 and H20; chlorine and water
D. H+ and OH-; ions

17. Discuss the effect on chlorination of the following:
A. Contact Time

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_____
_____
_____

B. Temperature

_____
_____
_____
_____

C. pH

_____
_____

D. Suspended Solids

E. Organic and Inorganic Materials

18. As chlorine is added to water, it reacts with organic and inorganic compounds until the reactions eventually cease. What endpoint has now been reached?
A. Chlorine residual
B. Chlorine dosage
C. Breakpoint chlorination
D. Chlorine demand

19. Which of the following forms of chlorine is MOST effective at killing bacteria?
A. Elemental chlorine gas
B. Combined available chlorine
C. Free available chlorine
D. Breakpoint chlorination

20. When chlorine comes in contact with an organic material, what carcinogenic compound may be created?
A. Chlorine gas
B. Trihalomethanes
C. Hydrogen

22. Describe the major components of a distribution system.

23. Why would ammonia be added to water while disinfecting with chlorine?
A. To improve the taste of the water
B. To adjust the pH
C. To create chloramines
D. To create free available chlorine residuals

24. Discuss the reasons for metering water.

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25. What does a positive bacteriological sample indicate?
A. The absence of bacteriological contamination
B. The presence of bacteriological contamination
C. The presence of excess nitrate
D. The presence of fecal coliform

26. Which of the following chemicals is used to dechlorinate a water sample that is analyzed for bacteria?
A. Sodium chloride
B. Sodium hydroxide
C. Sodium hyposulfite
D. Sodium sulfate

27. Describe how to get good mixing of the chlorine solution.

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_____

28. Discuss operational storage concerns when using the following:
A. Sodium Hypochlorite and Calcium Hypochlorite.

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29. The hydrolysis of chlorine results in the formation of which two main chemical species?
A. Chlorine gas and water
B. Hypochlorous acid and hydrochloric acid
C. Hypochlorite and Hypochlorous acid
D. Chlorine gas and chloric acid

30. What are the two most common chemical problems that change the quality of water in a storage tank?
A. Leachate from internal coatings and tank corrosion
B. The loss of disinfection residual and a change in the taste and odor
C. An increase in pH and the formation of disinfection by-products
D. The loss of disinfection residual and the formation of disinfection by-products

31. Which of the following dos a lantern ring accomplish?
A. Lubricates the packing
B. Helps keep air form entering the pump
C. Both A and B

32. What causes the development of THMs during the chlorination of water?
A. The reaction of chlorine with low pH water
B. The reaction of chlorine with a reducing agent
C. The reaction of chlorine with organic material
D. The reaction of chlorine with humic substances and sodium

33. Which one of the following diseases in NOT transmitted by water?
A. Dysentery
B. AIDS
C. Hepatitis
D. Cholera

34. Explain why a chlorine contact tank should be cleaned.

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35. Bottles for collecting samples for bacteriological analyses contain _____, which destroys any chlorine residual in the sample.
A. Sodium arsenite
B. Sodium chloride
C. Sodium fluoride
D. Sodium hydroxide
E. Sodium thiosulfate

36. Define the organism used to determine the effectiveness of disinfection.

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37. Explain the significance of the use of an indicator organism.

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39. Describe where samples should be taken to measure the effectiveness of disinfection.

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40. Explain the type of fecal coliform sample to be taken, what the sample holding time would be, and sample preservation requirements.

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_____

41. Explain the type of chlorine residual sample to be taken, where to collect the sample, and the recommended holding time.

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42. What are monochloramine, dichloramine, and trichloramine known as?
A. Combined available chlorine
B. Breakpoint chlorine
C. Free available chlorine
D. Chlorine dioxide

43. List the three recommended testing methods for total chlorine residual.

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44. What is the definition of breakpoint chlorination?
A. Adding chlorine to water until the chlorine demand is satisfied and at the maximum reduction of the chlorine residual
B. To add chlorine until the desired free chlorine residual is achieved
C. To add chlorine until all microorganisms are killed
D. To add chlorine until all species of chloramines are formed

45. Define coliform and pathogenic bacteria.

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46. What are mudballs and how can they be prevented?

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47. List the possible causes of fecal coliform levels that exceed permit levels for chlorination systems.

48. List the causes of high chlorine residuals following dechlorination.

49. Explain what effect chlorine or sulfur dioxide gas has when released into a moist atmosphere.

50. Discuss the significance of discoloration or corrosion of gas piping systems.

51. State the water quality significance of the following:
A. pH.

B. Oxygen.

C. Manganese.

D. Iron.

E. Hardness.

F. Alkalinity.

G. Iron Bacteria.

H. Natural Organic Matter (NOM)

52. Define the following storage facilities:
A. Stand Pipes.

B. Reservoirs.

C. Elevated Tanks.

53. Describe the functions that elevated water storage serves in a distribution system.

54. Discuss the properties of the following types of pipe:
A. Ductile Iron.

B. Cast Iron.

C. Asbestos cement.

D. Plastic (PVC).

E. Steel.

F. Reinforced Concrete.

55. Identify these different types of valves used in a distribution system.
A. Ball Valves

B. Bellows Valves

C. Check Valves

D. Diaphragm Valves

E. Gate / Knife Valves

F. Globe Valves

G. Pressure Relief Valves

H. Metering Valves

56. Describe the operation and use of a gate valve.

57. Describe the operation and use of a butterfly valve.

58. Identify the different types of pumps used in a distribution system.

59. Describe the function of the following parts of a centrifugal pump:
A. Impeller.

B. Shaft.

C. Sleeves.

D. Bearings.

E. Lantern Ring.

F. Mechanical Seal.

G. Pump Casing.

H. Packing.

I. Packing Gland.

J. Volute.

60. Describe how a centrifugal pump works.

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61. List and describe the function of the basic elements of a fire hydrant.

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62. List the types of meters used in a distribution system.

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63. Identify locations where thrust blocks and tie rods should be used.

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64. List the common types of flow measuring and water level measurement devices.

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65. Describe where flow meters should be located to accurately measure distribution flows.

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DATE_____