Registration form

Chlorine & Disinfection CEU Training Course $200.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL $50.00

Start and Finish Dates: _____ *You will have 90 days from this date in order to complete this course*

Name_____Signature_____
I have read and understood the disclaimer notice on page 2. Digitally sign XXX

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Email_____ Fax (_____) _____

Phone:
Home (_____) _____Work (_____) _____

Operator ID# _____Exp Date_____

Please circle/check which certification you are applying the course CEU's.
Water Treatment _____ Distribution _____ Collection _____

Wastewater Treatment_____ Other _____

Your certificate will be mailed to you in about two weeks.

Technical Learning College PO Box 420, Payson AZ 85547-0420
Primary Fax (928) 272-0747 info@tlch2o.com
Telephone (928) 468-0665 Toll Free (866) 557-1746

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Purchase Order #, Please invoice me _____

We will stop mailing the certificate of completion we need your e-mail address. We will e-mail the certificate to you, if no e-mail address; we will mail it to you.

DISCLAIMER NOTICE
I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

State Approval Listing Link, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. If the course is not accepted for CEU credit, we will give you the course free if you ask your State to accept it for credit.

Professional Engineers; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

State Approval Listing URL…
http://www.tlch2o.com/PDF/CEU%20State%20Approvals.pdf

You can obtain a printed version of the course from TLC for an additional $79.95 plus shipping charges.

AFFIDAVIT OF EXAM COMPLETION
I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

Grading Information
In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

Chlorine and Disinfection CEU Course Answer Key

Name _____ ***Telephone #*** _____

Please select one answer. You can circle, underline, bold or X the answer.

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Please e-mail or fax this survey along with your final exam

CHLORINE & DISINFECTION CEU TRAINING COURSE
CUSTOMER SERVICE RESPONSE CARD

NAME: _____

E-MAIL_____PHONE_____

PLEASE COMPLETE THIS FORM BY CIRCLING THE NUMBER OF THE APPROPRIATE ANSWER IN THE AREA BELOW.

1. Please rate the difficulty of your course.
   Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.
   Very Easy 0 1 2 3 4 5 Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.
   Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course?_____

5. What would you do to improve the Course?

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How about the price of the course? Poor __ Fair__ Average__ Good __ Great __

How was your customer service? Poor __ Fair__ Average__ Good __ Great __

Any other concerns or comments.

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Chlorine and Disinfection CEU Course Answer Key

The Chlorine and Disinfectant CEU Assignment is available in Word on the Internet for your Convenience, please visit www.ABCTLC.com and download the assignment and e mail it back to TLC. You can also find complete assistance under the Assistance Page.

You will have 90 days from receipt of this manual to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. If you should need any assistance, please email all concerns and the completed manual to info@tlch2o.com.

I would prefer that you utilize the enclosed answer sheet at the rear of this manual, but if you are unable to do so, type out your own answer key. Please include your name and address on your manual and make copy for yourself.

Multiple Choice, please select only one answer per question. There are no intentional trick questions.

Safe Drinking Water Act (SDWA)

1. In 1974, Congress passed the Safe Drinking Water Act (SDWA) setting up a regulatory program among local, state, and federal agencies to_____.
A. Develop Wellhead Protection Programs
B. Provide public notification of contamination problems
C. Help ensure the provision of safe drinking water in the U.S
D. Requiring monitoring
E. None of the Above

2. The states are expected to administer and _____ for public water systems (systems that either have 15 or more service connections or regularly serve an average of 25 or more people daily for at least 60 days each year).
A. Set numerical standards
B. Develop procedures
C. Set treatment requirements
D. Site-specific criteria are not met
E. None of the Above

3. Public water systems_____, ensure proper drinking water quality through monitoring, and provide public notification of contamination problems.
A. Develop Wellhead Protection Programs
B. Provide public notification of contamination problems
C. Safe drinking water in the U.S
D. Must provide water treatment
E. None of the Above

4. Relating to prevention of waterborne disease, the SDWA required EPA to: _____, referred to as Maximum Contaminant Levels (MCLs — the highest allowable contaminant concentrations in drinking water) or treatment technique requirements for contaminants in public water supplies.
A. Set numerical standards
B. Develop procedures
C. Set treatment requirements
D. Site-specific criteria are not met
E. None of the Above

5. Issue regulations _____ of all regulated and certain unregulated contaminants, depending on the number of people served by the system, the source of the water supply, and the contaminants likely to be found;
A. Develop Wellhead Protection Programs
B. Provide public notification of contamination problems
C. Safe drinking water in the U.S
D. Requiring monitoring
E. None of the Above

6. Set criteria under which systems are obligated to filter water from surface water sources; it must also develop procedures for states to determine which systems have to filter;
A. Set numerical standards
B. Develop procedures
C. Set treatment requirements
D. Site-specific criteria are not met
E. None of the Above

7. Develop disinfection rules for all public water supplies; and require all states to develop Wellhead Protection Programs _____that supply public drinking water systems.
A. Develop Wellhead Protection Programs
B. Provide public notification of contamination problems
C. Designed to protect from sources of contamination areas around wells
D. Requiring monitoring
E. None of the Above

8. Through the Surface Water Treatment Rule (SWTR), EPA has _____ to control microbiological contaminants in public water systems using surface water sources (and ground-water sources under the direct influence of surface water).
A. Set numerical standards
B. Develop procedures
C. Set treatment requirements
D. Site-specific criteria are not met
E. None of the Above

9. These requirements include the following: treatment must remove or _____of Giardia lamblia cysts and 99.99% of viruses.
A. Develop Wellhead Protection Programs
B. Provide public notification of contamination problems
C. Safe drinking water in the U.S
D. Requiring monitoring
E. None of the Above

10. All systems must disinfect, and are required to filter if certain source water quality criteria and _____.
A. Set numerical standards
B. Develop procedures
C. Set treatment requirements
D. Site-specific criteria are not met
E. None of the Above

11. The _____for determining if treatment, including turbidity (suspended particulate matter) removal and disinfection requirements, is adequate for filtered systems; and all systems must be operated by qualified operators as determined by the states.
A. Set numerical standards
B. Develop procedures
C. Regulations set criteria
D. None of the Above

Current EPA Research –Barriers to Contamination

12. Although water treatment and disinfection techniques are quite effective at_____, finished drinking water is not sterile.
A. Water treatment and disinfection techniques
B. Microbe reduction
C. Organic compounds as carbon and energy sources
D. Suspended solids
E. None of the Above

13. Survival and regrowth of microorganisms in drinking water distribution systems can lead to the _____and even noncompliance of a supply.
A. Deterioration of water quality
B. Drinking water distribution systems
C. Organic compounds as carbon and energy sources
D. Suspended solids
E. None of the Above

14. Regrowth has largely been associated with _____(i.e., those bacteria – including pathogens – that require preformed organic compounds as carbon and energy sources).
A. Water treatment and disinfection techniques
B. Heterotrophic bacteria
C. Organic compounds as carbon and energy sources
D. Suspended solids
E. None of the Above

15. Bacterial growth occurs on the walls of the _____(referred to as “biofilms”) and in the water either as free living cells or cells attached to suspended solids.
A. Water treatment and disinfection techniques
B. Drinking water distribution systems
C. Distribution system
D. None of the Above

16. A _____, bacterial regrowth is influenced primarily by temperature, residence time in mains and storage units, the efficacy of disinfection, and nutrients.
A. Water treatment and disinfection techniques
B. Drinking water distribution systems
C. Organic compounds as carbon and energy sources
D. Multi-faceted phenomenon
E. None of the Above

Assimilable Organic Carbon (AOC)

17. Assimilable organic carbon (AOC) is the portion of the total organic carbon (TOC) dissolved in water that is easily used by microorganisms as a _____(i.e., nutrients).
A. Bacterial communities
B. Bacteria, viruses and protozoan cysts
C. Microorganisms
D. Carbon source
E. None of the Above

18. Researchers are currently investigating treatment processes to control AOC. One promising process is biologically active filtration wherein bacterial communities are intentionally established in the filters to use up, or biodegrade, the AOC as it passes through. This treatment process must be employed before final disinfection so that _____from the filter can be properly controlled.
A. Bacterial communities
B. Bacteria, viruses and protozoan cysts
C. Bacteria escaping
D. None of the Above

19. Most water utilities do not disinfect with chlorine until late in the treatment train. This limits the formation of _____(i.e., those compounds like chloroform produced when chlorine reacts with naturally occurring organic carbon).
A. Bacterial communities
B. Disinfection by-products
C. Microorganisms
D. Naturally occurring organic carbon
E. None of the Above

20. To accomplish disinfection earlier in treatment, some water utilities employ ozonation. While ozone is a_____, it also converts a portion of the TOC into AOC.
A. Bacterial communities
B. Bacteria, viruses and protozoan cysts
C. Microorganisms
D. Very strong disinfectant
E. None of the Above

21. Researchers are examining the advantages (e.g., disinfection of bacteria, viruses and protozoan cysts, control of color, control of taste and odor, _____, and partial oxidation of the naturally occurring organic carbon that reacts with chlorine) and disadvantages of ozone (e.g., enhancement of AOC, conversion of bromide to bromate, and formation of its own disinfection byproducts like formaldehyde).
A. Bacterial communities
B. Bacteria, viruses and protozoan cysts
C. Microorganisms
D. Naturally occurring organic carbon
E. None of the Above

Microorganisms Associated with Waterborne Disease

The following groups of microorganisms have been linked with the occurrence of waterborne disease. As each pathogen is isolated and identified as a threat to water quality, researchers try to discover the most effective combination of barriers and disinfection methods to minimize risk of human exposure.

22. Bacteria. Bacteria are the most widely distributed life forms. _____ range in length from approximately 0.4 to 14 mm (a mm or “micrometer” equals one one-thousandth of a millimeter) and 0.2 to 1.2 mm in width.
A. Pathogenic bacteria
B. Waterborne disease
C. Key bacterial pathogens
D. Bacteria and viruses
E. None of the Above

23. Key bacterial pathogens responsible for _____ include Legionella, Salmonella typhi, Shigella, and Vibrio cholerae.
A. Pathogenic bacteria
B. Waterborne disease
C. Key bacterial pathogens
D. Bacteria and viruses
E. None of the Above

24. Viruses. Viruses are inactive when outside of a living host cell. Viruses linked to waterborne disease have protein coats that provide protection from _____and range in size from 0.02 to 0.09 mm.
A. Pathogenic bacteria
B. Waterborne disease
C. Environmental hazards
D. Bacteria and viruses
E. None of the Above

25. Unlike bacteria and protozoa, they contain only one type of nucleic acid (RNA or DNA). Key pathogens include_____.
A. Pathogenic bacteria
B. Hepatitis A and Norwalk virus
C. Key bacterial pathogens
D. Bacteria and viruses
E. None of the Above

26. Protozoa. Protozoa, common in bodies of water, are much larger than bacteria and viruses. To survive harsh environmental conditions, some species can secrete a protective covering and form a resting stage called a "_____."
A. Pathogenic bacteria
B. Waterborne disease
C. Cyst
D. Bacteria and viruses
E. None of the Above

27. Encystment can protect protozoa from drinking water disinfection efforts and facilitate the spread of disease. Key protozoa being studied as agents of waterborne disease include _____ and Cryptosporidium.
A. Pathogenic bacteria
B. Waterborne disease
C. Giardia
D. Bacteria and viruses
E. None of the Above

Protozoan Diseases
28. Two protozoans in the news today are Giardia and Cryptosporidium. Their consumption can lead to severe problems of the digestive system, which can be life-threatening to the very young, very old, or those with_____.
A. Pathogenic bacteria
B. Damaged immune systems
C. Key bacterial pathogens
D. Bacteria and viruses
E. None of the Above

Current EPA Research —Bacteria

29. The new National Primary Drinking Water Regulations require that all drinking water samples testing positive for total coliforms be further tested for the presence of either_____.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Fecal coliforms or E. coli
D. The variant
E. None of the Above

30. There is a method currently available that allows the simultaneous detection of _____in a broth medium in 24 hours; however, there is no equivalent method for use with membrane filters. Development of such a method will allow those who prefer to obtain counts of these organisms in their distribution systems to use a membrane filter method and to have results within the 24-hour time frame.
A. E. coli
B. Fecal organisms
C. Coliform-positive drinking water samples
D. Total coliforms and E. coli
E. None of the Above

31. Through the project "Development of a Membrane Filter Medium for the Simultaneous Detection of Total Coliforms and_____," a membrane filter medium on which both total coliforms and E. coli can be distinguished from non-coliforms will be developed and patented.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. E. coli
D. The variant
E. None of the Above

32. _____ are fecal organisms that when present in drinking water are indicative of fecal pollution. Logistical concerns in sample handling and holding require evaluation of conditions for optimizing sample stability and longevity.
A. E. coli
B. Fecal organisms
C. Coliform-positive drinking water samples
D. Vibrio cholerae
E. None of the Above

33. No current regulations exist for handling samples for analysis of E. coli. Through the project entitled "Optimal Sample Holding Conditions for Analysis of Fecal E.coli in Drinking Water," sample temperature and holding time will be determined for E. coli or _____(i.e., Colilert and M-FC agar).
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Vibrio cholerae
D. Fecal coliform analysis methods
E. None of the Above

34. Relative recovery of methods and storage conditions will be assessed for optimal E. coli recovery. The requirement (through the SDWA amendments) to test all coliform-positive drinking water samples for either fecal coliforms or _____ is new.
A. E. coli
B. Fecal organisms
C. Coliform-positive drinking water samples
D. Vibrio cholerae
E. None of the Above

35. Data from available methods for detecting chlorine damaged E. coli in drinking water are limited. The objective of the project entitled "Detection of Low Numbers of _____ in Drinking Water" is to evaluate and compare the abilities of a commercial method (Colilert) and a standard coliform method (ECMUG) to recover low numbers of chlorine-stressed E. coli from potable water.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Vibrio cholerae
D. The variant
E. None of the Above

36. Pure cultures of E. coli will be washed, nutrient-stressed in finished drinking water, and treated with chlorine. The chlorine-stressed _____ will then be enumerated, diluted to levels that would be found in marginally unsafe drinking water and assayed in multiple tubes by the three methods.
A. E. coli
B. Fecal organisms
C. Coliform-positive drinking water samples
D. Vibrio cholerae
E. None of the Above

37. These experiments will be repeated using naturally occurring E. coli from diluted human fecal specimens, contaminated source waters and effluents. The infectious bacterial agent identified from the stools of cholera victims is _____. The epidemic in Latin America has prompted a renewed interest in control measures for this disease.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Vibrio cholerae
D. The variant
E. None of the Above

38. Through the project entitled "Inactivation of Vibrio cholerae Biotype _____and Biotype Classical by Chlorination," it has been determined that the strain responsible for the epidemic in Peru is capable of reverting to a variant which is more resistant to chlorination than the typical smooth variety of Vibrio cholerae.
A. El Tor
B. Fecal organisms
C. Coliform-positive drinking water samples
D. Vibrio cholerae
E. None of the Above

39. Cells of the variant appear to be imbedded in a gelatinous mucoid material, facilitating the formation of aggregates, which renders them more resistant to disinfection. Although _____ is more resistant, studies have indicated that all strains are readily inactivated through adequate chlorination.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Vibrio cholerae
D. The variant
E. None of the Above

40. The Legionella pneumophila bacterial strains that cause community- and hospital-acquired pneumonia are usually spread via finished drinking water. Certain free living amoebae (protozoa) support the multiplication of _____in drinking water systems.
A. E. coli
B. Fecal organisms
C. L. pneumophila
D. Vibrio cholerae
E. None of the Above

41. These amoebae may also be responsible for enhancing the virulence (capacity of a microorganism to cause disease) of the _____and for protecting them from adverse environmental factors such as high temperature and chlorine disinfection.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Vibrio cholerae
D. Legionellae
E. None of the Above

42. Combinations of _____ isolates and specific amoebae that result in high yields of Legionella after intracellular growth will be used to study the effects of intracellular growth on virulence.
A. E. coli
B. Fecal organisms
C. Legionella
D. Vibrio cholerae
E. None of the Above

43. Preliminary studies on the ability of _____to supply iron to Legionellae growing intracellularly showed no obvious associations between growth and iron concentration. EPA is required by the SDWA to establish appropriate controls and regulations for potable water.
A. Fecal E.coli
B. Chlorine-stressed E. coli
C. Vibrio cholerae
D. Amoebae
E. None of the Above

44. Although virulence is usually measured in vivo (animal research), the need for extensive animal testing can be significantly reduced by the development of a battery of in vitro (cell culture) tests for traits known to be_____. This battery can be used to predict the potential an organism has for causing disease in exposed populations.
A. E. coli
B. Virulence-related
C. Virulence
D. Vibrio cholerae
E. None of the Above

Fecal Pollution

45. Some believe that exposure to _____through recreational waters or ingestion of contaminated shellfish causes greater health risks if the pollution is of human rather than animal origin.
A. Global epidemiology
B. Fecal pollution
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

46. Before the relative risks of human versus animal fecal pollution can be assessed, it is necessary to develop a _____for distinguishing human from animal pollution.
A. Microbiological method
B. Optimal pathogen removal techniques
C. Associated with water-borne illnesses
D. Conventional methods
E. None of the Above

47. Current methods detect fecal pollution but do not reveal the source. The objective of the project entitled “Method to Distinguish Non-Human Fecal Pollution from Human Fecal Pollution” is to develop a gene probe specific for E. coli that inhabit the human intestine for use as_____.
A. An indicator of the presence of human fecal contamination in water
B. Humans are the reservoir for this pathogen
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

48. The probe will be field tested at several sites in which _____is exclusively from human sources, exclusively from animal sources and from mixed sources.
A. Fecal pollution
B. Optimal pathogen removal techniques
C. Associated with water-borne illnesses
D. Conventional methods
E. None of the Above

Shigella Species

49. Shigella species are among the most common and significant pathogens associated with wastewater and sludge. Because of their low infective doses, these organisms may be hazardous even if present in low numbers in wastewaters that are _____or sludges that are applied to agricultural land.

A. Global epidemiology
B. Humans are the reservoir for this pathogen
C. Recycled for potable use
D. Inactivate/remove pathogens
E. None of the Above

50. Shigellae are very difficult to detect in _____because of their biochemical similarities to E. coli.

A. Halogenation of water
B. Optimal pathogen removal techniques
C. Associated with water-borne illnesses
D. Environmental samples by conventional methods
E. None of the Above

Conclusion

51. _____constitute a major health hazard in both developed and developing nations. A new dimension to the global epidemiology of cholera-an ancient scourge-was provided by the emergence of Vibrio cholerae O139. Also, water-borne enterohaemorrhagic Escherichia coli (E. coli O157:H7), although regarded as a problem of the industrialized west, has recently caused outbreaks in Africa.

A. Emerging waterborne pathogens
B. Humans are the reservoir for this pathogen
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

52. Outbreaks of _____have motivated water authorities to reassess the adequacy of current water-quality regulations. Of late, a host of other organisms, such as hepatitis viruses (including hepatitis E virus), Campylobacter jejuni, microsporidia, cyclospora, Yersinia enterocolitica, calciviruses and environmental bacteria like Mycobacterium spp, aeromonads, Legionella pneumophila and multidrug-resistant Pseudomonas aeruginosa have been associated with water-borne illnesses.

A. Halogenation of water
B. Optimal pathogen removal techniques
C. Associated with water-borne illnesses
D. Conventional methods
E. None of the Above

53. The protection and enhancement of our nation's water quality remains a chief concern of the U.S. Environmental Protection Agency. The Office of Research and Development is committed, through the extensive waterborne disease research efforts earlier described, to ensure that the most effective and efficient methods are developed to identify, detect, and _____ that may be present in our drinking water supplies.

A. Global epidemiology
B. Humans are the reservoir for this pathogen
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

54. Life cycles, mechanisms of infection, protective or dormant states, emergence of disinfection resistant variants, optimal pathogen removal techniques, regrowth in distribution lines…all are areas that must be investigated and understood to afford the _____that are so often taken for granted. The successes and failures of these research efforts, relayed to the public and appropriate federal, state, and local agencies, have helped to ensure safe drinking water.
A. Halogenation of water
B. Optimal pathogen removal techniques
C. Water quality safeguards
D. Conventional methods
E. None of the Above

Salmonella Typhi
55. Salmonella typhi, the basics. It's a bacteria. It causes diarrheal illness, also known as typhoid fever. And _____. Salmonella typhi, prevention.
A. Global epidemiology
B. Humans are the reservoir for this pathogen
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

56. Prevention strategies for this pathogen include_____, halogenation of water, and boiling water for one minute.
A. Halogenation of water
B. Optimal pathogen removal techniques
C. Source protection
D. Conventional methods
E. None of the Above

Shigella Species
57. Shigella species, the basics. It's a bacteria. It causes diarrheal illness known as shigellosis. Humans and primates are the reservoir for this pathogen. Shigella species, in the United States two-thirds of the shigellosis in the U.S. is caused by Shigella sonnei, and the remaining one-third is caused by Shigella flexnieri. In developing countries, Shigella dysenteriae is the_____.
A. Primary cause of illness associated with this pathogen
B. Humans are the reservoir for this pathogen
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

Campylobacter
58. Campylobacter, the basics. It's a bacteria. It causes diarrheal illness. And Campylobacter is primarily associated with_____.
A. Halogenation of water
B. Optimal pathogen removal techniques
C. Associated with water-borne illnesses
D. Poultry, animals, and humans
E. None of the Above

59. Campylobacter prevention. Prevention strategies for this pathogen include_____, halogenation of water, and boiling water for one minute.
A. Source protection
B. Humans are the reservoir for this pathogen
C. Low infective doses
D. Inactivate/remove pathogens
E. None of the Above

Vibrio Cholerae

60. Vibrio cholerae, the basics. It's a bacteria. It causes diarrheal illness, also known as cholera. It is typically associated with_____, shell stocks, and human.

A. Halogenation of water
B. Optimal pathogen removal techniques
C. Associated with water-borne illnesses
D. Aquatic environments
E. None of the Above

Legionella

61. Legionella, the basics. It's a bacteria. It causes a respiratory illness known as legionellosis. There are two illnesses associated with legionellosis: the first, Legionnaire's disease, which causes a severe pneumonia, and the second, Pontiac fever, which is a _____; it's typically an influenza-like illness, and it's less severe.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Non-pneumonia illness
D. Pathogen
E. None of the Above

62. Legionella is naturally found in water, both natural and artificial water sources. Legionella prevention. Maintaining hot water systems at or above 50 degrees Centigrade and cold water below 20 degrees Centigrade can prevent or control the _____ in water systems. Hot water in tanks should be maintained between 71 and 77 degrees Centigrade.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Reservoir for Hepatitis A virus
D. Pathogen
E. None of the Above

63. Proper recreational water system maintenance and disinfection can prevent the proliferation of Legionella in recreational water systems. It is important to prevent water stagnation. This can be accomplished by eliminating dead ends in distribution systems and in recreational water systems. Additionally, preventing biofilm development is important to control this _____in water systems.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Reservoir for Hepatitis A virus
D. Particular pathogen
E. None of the Above

Pseudomonas

64. Pseudomonas, the basics. It's a bacteria. It is caused by dermal contact with water. It can cause_____, which is an inflammation of the skin, or it can cause otitis, which is an infection of the ear. Pseudomonas is typically associated with soil and water.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Reservoir for Hepatitis A virus
D. Dermatitis
E. None of the Above

65. Pseudomonas, prevention. Proper maintenance and disinfection of recreational water systems is important in _____.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Reservoir for Hepatitis A virus
D. Pathogen
E. None of the Above

Hepatitis A

66. Hepatitis A, the basics. It's a virus. It causes inflammation of the liver. And the _____ is humans.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Reservoir for Hepatitis A virus
D. Pathogen
E. None of the Above

Hepatitis A, Prevention

67. Prevention strategies for this pathogen include source protection and adequate disinfection. Fecal matter can protect _____ from chlorine.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Hepatitis A virus
D. Pathogen
E. None of the Above

68. Additionally, _____is resistant to combined chlorines, so it is important to have an adequate free chlorine residual.

A. Proliferation of Legionella
B. Preventing Pseudomonas
C. Hepatitis A virus
D. Pathogen
E. None of the Above

Norovirus

69. Norovirus, the basics. It's a virus. It causes diarrheal illness. And_____. Norovirus, prevention. Prevention strategies for this pathogen include source protection.

A. Proliferation of Legionella
B. Humans are the reservoir for this virus
C. Reservoir for Hepatitis A virus
D. Pathogen
E. None of the Above

Cryptosporidium

70. Cryptosporidium, the basics. It's a_____. It causes diarrheal illness known as cryptosporidiosis. It is typically associated with animals and humans, and it can be acquired through consuming fecally contaminated food, contact with fecally contaminated soil and water.

A. Legionella
B. Parasite
C. Cryptosporidiosis
D. Giardiasis
E. None of the Above

71. Cryptosporidium, prevention. Prevention strategies for this _____include source protection. A CT value of 9,600 is required when dealing with fecally accidents. CT equals a concentration, in parts per million, while time equals a contact time in minutes.

A. Legionella
B. Pathogen
C. Cryptosporidiosis
D. Giardiasis
E. None of the Above

72. Cryptosporidium can also be prevented or eliminated by boiling water for one minute. Filtration with an "absolute" pore size of one micron or smaller can eliminate_____. And reverse osmosis is known to be effective as well.
A. Cryptosporidium
B. Pseudomonas
C. Cryptosporidiosis
D. Giardiasis
E. None of the Above

Giardia
73. Giardia, the basics. It is a parasite. It causes diarrheal illness known as _____. It is typically associated with water. It is the most common pathogen in waterborne outbreaks. It can also be found in soil and food. And humans and animals are the reservoir for this pathogen.
A. Legionella
B. Pseudomonas
C. Cryptosporidiosis
D. Giardiasis
E. None of the Above

74. Giardia, prevention. Prevention strategies for this _____ include source protection; filtration, coagulation, and halogenation of drinking water.
A. Dermatitis
B. Pathogen
C. An antihelmetic drug
D. Giardiasis
E. None of the Above

Schistosomatidae
75. Schistosomatidae, the basics. It is a parasite. It is acquired through dermal contact, cercarial _____. It is commonly known as swimmer's itch.
A. Dermatitis
B. Pathogen
C. An antihelmetic drug
D. Giardiasis
E. None of the Above

76. The reservoir for this pathogen are aquatic snails and birds. Schistosomatidae, prevention. Prevention strategies for this _____ include eliminating snails with a molluscicide or interrupting the life cycle of the parasite by treating birds with an antihelmetic drug.
A. Dermatitis
B. Pathogen
C. An antihelmetic drug
D. Giardiasis
E. None of the Above

Disinfection Rules

77. In the past 25 years, the Safe Drinking Water Act (SDWA) has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water. _____is one of the major public health advances in the 20th century.
A. Carbon-containing compounds
B. Organism destruction
C. Chlorine oxidizes compounds
D. Disinfection of drinking water
E. None of the Above

78. One hundred years ago, typhoid and cholera epidemics were common through American cities; _____was a major factor in reducing these epidemics.
A. Disinfection
B. Organic matter
C. Chlorine-based compounds
D. Public water supplies
E. None of the Above

79. However, the disinfectants themselves can react with naturally-occurring materials in the water to form unintended byproducts which may pose health risks. In addition, in the past ten years, we have learned that there are_____, such as Cryptosporidium, which can cause illness and is resistant to traditional disinfection practices.
A. Carbon-containing compounds
B. Organism destruction
C. Specific microbial pathogens
D. Naturally-occurring materials
E. None of the Above

80. _____is the most widely used water disinfectant due to its effectiveness and cost. Using chlorine as a drinking water disinfectant has prevented millions of water borne diseases, such as typhoid, cholera, dysentery, and diarrhea.
A. Chlorine
B. Organic matter
C. Chlorine-based compounds
D. Public water supplies
E. None of the Above

81. Most states require community water systems to use chlorination. However, research shows that chlorine has side effects. It reacts with _____and forms a series of compounds that have been linked to cancer in animals.
A. Carbon
B. Organic matter present in water
C. Chlorine-based compounds
D. Public water supplies
E. None of the Above

82. These compounds are called disinfection by-products (DBPs). All disinfectants form DBPs in one of two reactions: Chorine and chlorine-based compounds (halogens) react with _____in water causing the chlorine atom to substitute other atoms resulting in halogenated by-products and
A. Carbon
B. Organic matter
C. Chlorine-based compounds
D. Organics
E. None of the Above

83. Oxidation reactions, where chlorine oxidizes compounds present in water. _____are also formed when multiple disinfectants are used.
A. Carbon-containing compounds
B. Secondary by-products
C. Chlorine oxidizes compounds
D. Naturally-occurring materials
E. None of the Above

84. All living organisms have carbon as an essential element in their cells. When trees shed their leaves, they start decomposing and are ultimately broken down by bacteria into_____.
A. Carbon
B. Organic matter
C. Chlorine-based compounds
D. Carbon-containing compounds
E. None of the Above

85. Similarly, dead animals on land and fish and other aquatic life decompose and disintegrate into compounds that contain carbon as an essential element. Hence, all surface water and groundwater contain varying amounts of carbon-containing compounds called _____(primarily humic and fulvic acids).
A. Carbon-containing compounds
B. Organism destruction
C. Organic matter
D. Naturally-occurring materials
E. None of the Above

86. The _____requires systems using public water supplies from either surface water or groundwater under the direct influence of surface water to disinfect.
A. Carbon
B. Organic matter
C. Chlorine-based compounds
D. Public water supplies
E. None of the Above

87. Also, since some disinfectants produce_____, the dual objective of disinfection is to provide the required level of organism destruction and remain within the maximum contaminant level (MCL) for the SWTR disinfection set by EPA.
A. Carbon-containing compounds
B. Chemical by-products
C. Chlorine oxidizes compounds
D. Naturally-occurring materials
E. None of the Above

88. The Disinfectants and Disinfection Byproducts (DBP) rules apply to all community and non-community water systems using a disinfectant such as_____.
A. Chlorine, chloramines, ozone and chlorine dioxide
B. Organic matter
C. Chlorine-based compounds
D. Public water supplies
E. None of the Above

89. The Long Term 2 Enhanced Surface Water Treatment Rule (LT2) rule applies to all water systems using surface water, groundwater under the influence of a surface water, as well as groundwater/surface water blends. The LT2 requirements began in 2006 with the characterization of _____and E.coli levels. Systems serving <10,000 monitor for E.coli only every two weeks for one year. Compliance with the LT2 requirements begin in April 2013.
A. Carbon-containing compounds
B. Raw water Cryptosporidium
C. Chlorine oxidizes compounds
D. Naturally-occurring materials
E. None of the Above

90. The Groundwater Rule (GWR) applies to all public water systems using groundwater. The GWR requirements begin in March 2009 with 6-months investigative monitoring (IM) for_____, for systems currently applying disinfection only. All other requirements for the GWR began back in Dec 2009.
A. Bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate
B. DBPs
C. Total trihalomethanes
D. Source water E.coli
E. None of the Above

91. Amendments to the _____ in 1996 require EPA to develop rules to balance the risks between microbial pathogens and disinfection byproducts (DBPs). It is important to strengthen protection against microbial contaminants, especially Cryptosporidium, and at the same time, reduce potential health risks of DBPs.
A. SDWA
B. Microbial and Disinfection Byproducts Rules (MDBPs)
C. Stage 2 DBPR
D. Stage 1 Disinfectants and Disinfection Byproducts Rule
E. None of the Above

92. The Stage 1 Disinfectants and Disinfection Byproducts Rule and Interim Enhanced Surface Water Treatment Rule, announced in December 1998, are the first of a _____ under the 1996 SDWA Amendments.
A. Bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate
B. DBPs
C. Total trihalomethanes
D. Primary or residual disinfectant other than UV
E. None of the Above

Public Health Concerns
93. While _____ are effective in controlling many microorganisms, they react with natural organic and inorganic matter in source water and distribution systems to form DBPs. Results from toxicology studies have shown several DBPs (e.g., bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate) to be carcinogenic in laboratory animals. Other DBPs (e.g., chlorite, bromodichloromethane, and certain haloacetic acids) have also been shown to cause adverse reproductive or developmental effects in laboratory animals.
A. SDWA
B. Microbial and Disinfection Byproducts Rules (MDBPs)
C. Stage 2 DBPR
D. Stage 1 Disinfectants and Disinfection Byproducts Rule
E. None of the Above

94. Several epidemiology studies have suggested a weak association between certain cancers (e.g., bladder) or reproductive and developmental effects, and exposure to chlorinated surface water. More than 200 million people consume water that has been disinfected. Because of the large population exposed, health risks associated with _____, even if small, need to be taken seriously.
A. Bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate
B. DBPs
C. Total trihalomethanes
D. Primary or residual disinfectant other than UV
E. None of the Above

Who Must Comply With The Rule?

95. The _____ applies to all community and nontransient non-community water systems that treat their water with a chemical disinfectant for either primary or residual treatment.

A. SDWA
B. Microbial and Disinfection Byproducts Rules (MDBPs)
C. Stage 2 DBPR
D. Stage 1 Disinfectants and Disinfection Byproducts Rule
E. None of the Above

What Does The Rule Require?

96. The Stage 1 Disinfectant and Disinfection Byproduct Rule updates and supersedes the 1979 regulations for _____. In addition, it will reduce exposure to three disinfectants and many disinfection byproducts.

A. Bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate
B. DBPs
C. Total trihalomethanes
D. Primary or residual disinfectant other than UV
E. None of the Above

Stage 2 DBP Rule Federal Register Notices

97. The _____ rule is one part of the Microbial and Disinfection Byproducts Rules (MDBPs), which are a set of interrelated regulations that address risks from microbial pathogens and disinfectants/disinfection byproducts.

A. SDWA
B. Microbial and Disinfection Byproducts Rules (MDBPs)
C. Stage 2 DBP
D. Stage 1 Disinfectants and Disinfection Byproducts Rule
E. None of the Above

98. The _____rule focuses on public health protection by limiting exposure to DBPs, specifically total trihalomethanes (TTHM) and five haloacetic acids (HAA5), which can form in water through disinfectants used to control microbial pathogens.

A. SDWA
B. Microbial and Disinfection Byproducts Rules (MDBPs)
C. Stage 2 DBP
D. Stage 1 Disinfectants and Disinfection Byproducts Rule
E. None of the Above

99. This rule will apply to all community water systems and nontransient non-community water systems that add a primary or residual disinfectant other than ultraviolet (UV) light or deliver water that has been disinfected by a _____.

A. Bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate
B. DBPs
C. Total trihalomethanes
D. Primary or residual disinfectant other than UV
E. None of the Above

100. In the past 30 years, the _____has been highly effective in protecting public health and has also evolved to respond to new and emerging threats to safe drinking water. Disinfection of drinking water is one of the major public health advances in the 20th century.

A. Safe Drinking Water Act (SDWA)
B. Microbial and Disinfection Byproducts Rules (MDBPs)
C. Stage 2 DBPR
D. None of the Above

101. Today, most of our drinking water supplies are free of the microorganisms — viruses, bacteria and _____— that cause serious and life-threatening diseases.
A. Chlorine
B. Ammonia
C. Protozoa
D. Disinfection
E. None of the Above

102. The most common chlorination by-products found in U.S. drinking water supplies are the_____ .
A. Haloacetic acids
B. Bromoform
C. Organic matter
D. Chloroform
E. None of the Above

103. The Principal Trihalomethanes are _____, bromodichloromethane, chlorodibromomethane and bromoform.
A. Haloacetic acids
B. Bromoform
C. Organic matter
D. Chloroform
E. None of the Above

104. Chlorine present as Cl, HOCl, and OCl^- is called **free available chlorine**, and that which is bound but still effective is _____.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

105. A particularly important group of compounds with combined chlorine is the chloramines formed by reactions with _____.
A. Chlorine
B. Ammonia
C. Protozoa
D. Disinfection
E. None of the Above

106. Use of chloramine or chlorine dioxide in chlorine disinfection produce fewer DBPs than chlorine, but have associated risks. _____ is not as strong a disinfectant as chlorine, and disinfection with chlorine dioxide produces its own DBPs.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

107. One especially important feature of disinfection using chlorine is the ease of overdosing to create a _____concentration.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

108. With _____, a typical residual is from 0.1 to 0.5 ppm.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

109. Living cells react with _____ and reduce its concentration while they die.
A. Chlorine
B. Ammonia
C. Protozoa
D. Disinfection
E. None of the Above

110. The organic matter and other substances that are present, convert to chlorinated _____, some of which are effective killing agents.
A. Chlorine
B. Ammonia
C. Protozoa
D. Derivatives
E. None of the Above

111. Because chlorinated organic compounds are less effective, a typical residual is 2 ppm for _____.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

112. There will be no chlorine _____ unless there is an excess over the amount that reacts with the organic matter present. However, reaction kinetics complicates interpretation of chlorination data. The correct excess is obtained in a method called Break Point Chlorination.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

113. Chlorination by-products are the chemicals formed when the chlorine used to kill disease- causing microorganisms reacts with naturally occurring _____ (e.g., decay products of vegetation) in the water.
A. Haloacetic acids
B. Bromoform
C. Organic matter
D. Chloroform
E. None of the Above

114. When disinfectants react with other chemicals, new compounds known as disinfectant by-products or "_____", are created. DBPs associated with chlorine disinfection include trihalomethanes (THMs), such as chloroform.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

115. Because chlorination has been used for almost 100 years to disinfect water supplies, approximately 40 percent of the DBPs from chlorination have been identified and researched. Much less is known about the kind of _____ produced by other disinfectants because of their relatively recent emergence.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

116. Other less common chlorination by-products includes the _____and haloacetonitriles.
A. Haloacetic acids
B. Bromoform
C. Organic matter
D. Chloroform
E. None of the Above

117. The amount of _____ formed in drinking water can be influenced by a number of factors, including the season and the source of the water.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

118. _____ concentrations are generally lower in winter than in summer, because concentrations of natural organic matter are lower and less chlorine is required to disinfect at colder temperatures.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

119. THM levels are also low when wells or large lakes are used as the drinking water source, because organic matter concentrations are generally low in these sources. The opposite — high organic matter concentrations and high _____ levels — is true when rivers or other surface waters are used as the source of the drinking water.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

120. Laboratory animals exposed to very high levels of _____ have shown increased incidences of cancer. Also, several studies of cancer incidence in human populations have reported associations between long-term exposure to high levels of chlorination by-products and an increased risk of certain types of cancer.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

121. _____ is a naturally existing element that has been used to disinfect drinking water supplies in America for most of the 20th Century.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

122. Animal research using high concentration of _____ found increased occurrence of cancer development, although why this occurs has not yet been determined. Research on the relationship between DBPs and cancer and other health risks is ongoing.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

123. American drinking water has **very low** concentrations of _____.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

124. _____ disinfection has been extremely effective in protecting drinking water resources from bacterial and viral contamination. It has virtually wiped out instances of water-borne diseases like typhoid fever, cholera and dysentery in America and other developed countries.
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

125. Over 200 million Americans currently drink water that has been _____.
A. Chloramine
B. DBP
C. THM
D. Disinfected
E. None of the Above

126. The three primary chemical agents used in chlorine disinfection are: free chlorine, chloramine (chlorine and ammonia bonded together) and chlorine dioxide (_____ and oxygen bonded together).
A. Chlorine
B. Residual
C. Free Available Chlorine
D. Combined Chlorine
E. None of the Above

127. _____ is also used to disinfect water.
A. Chloroform
B. DBP
C. THM
D. Ozone
E. None of the Above

128. The U.S. Environmental Protection Agency (USEPA) has **not** been able to link exposure to _____at low concentration levels and the health risks associated with high concentration level exposure.
A. Chloramine
B. DBP
C. THM
D. Ozone
E. None of the Above

129. Disinfectants are very active compounds. When added to a water supply, _____ not only kill bacteria and viruses, but also react with other chemicals present in the water. These chemicals generally enter the water supply through natural plant and soil breakdown.
A. Chloramine
B. DBP
C. THM
D. Disinfectants
E. None of the Above

130. The Safe Drinking Water Act Amendments of 1996 required USEPA to comply with the regulatory timeline it set forth in its initial Disinfectant and Disinfectant-By-Product (DDPB) rule and _____
A. Haloacetic acids
B. Bromoform
C. Organic matter
D. Chloroform
E. None of the Above

131. Because the research on _____ and their impact on public health continue, and because serious questions about the actual health risks posed by DBPs still remain, the increased.
A. DBPs
B. THMs
C. Chlorine
D. Ozone
E. None of the Above

132. Current evidence indicates that the benefits of chlorinating our drinking water — reduced incidence of water-borne diseases — are much greater than the risks of health effects from _____.
A. DBPs
B. THMs
C. Chlorine
D. Ozone
E. None of the Above

133. Although other disinfectants are available, _____ continues to be the choice of water treatment experts.
A. DBPs
B. THMs
C. Chlorine
D. Ozone
E. None of the Above

134. When used with modern water filtration practices, _____ is effective against virtually all infective agents — bacteria, viruses and protozoa.
A. DBPs
B. THMs
C. Chlorine
D. None of the Above

135. A number of cities use _____ to disinfect their source water and to reduce THM formation.
A. DBPs
B. THMs
C. Chlorine
D. Ozone
E. None of the Above

136. Although _____ is a highly effective disinfectant, it breaks down quickly, so that small amounts of chlorine or other disinfectants must be added to the water to ensure continued disinfection as the water is piped to the consumer's tap.
A. DBPs
B. THMs
C. Chlorine
D. Ozone
E. None of the Above

137. Modifying water treatment facilities to use _____ can be expensive, and ozone treatment can create other undesirable by-products that may be harmful to health if they are not controlled (e.g., bromate).
A. DBPs
B. THMs
C. Chlorine
D. Ozone
E. None of the Above

138. Examples of other disinfectants include chloramines and _____.
A. DBPs
B. THMs
C. Chlorine
D. Chlorine dioxide
E. None of the Above

139. _____ are weaker disinfectants than chlorine, especially against viruses and protozoa; however, they are very persistent and, as such, can be useful for preventing re-growth of microbial pathogens in drinking water distribution systems.
A. Chlorite
B. Chloramines
C. Chlorine
D. Ozone
E. None of the Above

140. _____can be an effective disinfectant, but it forms chlorate and chlorite, compounds whose toxicity has not yet been fully determined.
A. Chlorite
B. Chloramines
C. Chlorine
D. Chlorine dioxide
E. None of the Above

141. Assessments of the health risks from these and other chlorine-based disinfectants and _____ by-products are currently under way.
A. Chlorite
B. Chloramines
C. Chlorine
D. Chlorination
E. None of the Above

142. In general, the preferred method of controlling _____ by-products is removal of the naturally occurring organic matter from the source water so it cannot react with the chlorine to form by-products.
A. Chlorite
B. Chloramines
C. Chlorine
D. Chlorination
E. None of the Above

143. THM levels may also be reduced through the replacement of _____ with alternative disinfectants.
A. Chlorite
B. Chloramines
C. Chlorine
D. Chlorination
E. None of the Above

144. A third option is removal of the by-products by adsorption on activated carbon beds. It is extremely important that water treatment plants ensure that methods used to control _____by-products do not compromise the effectiveness of water disinfection.
A. Chlorite
B. Chloramines
C. Chlorine
D. Chlorination
E. None of the Above

145. A product of the disproportionation of chlorine dioxide, for example by sunlight.
A. Chloride ion (Cl^-)
B. Chlorate ion ($ClO3^-$)
C. Chlorine dioxide (ClO2)
D. CxT value
E. None of the Above

146. A free radical; a powerful, selective oxidant.
A. Chloride ion (Cl^-)
B. Chlorate ion ($ClO3^-$)
C. Chlorine dioxide (ClO2)
D. CxT value
E. None of the Above

147. The principal reduction product of chlorine.
A. Chloride ion (Cl^-)
B. Chlorate ion ($ClO3^-$)
C. Chlorine dioxide (ClO2)
D. CxT value
E. None of the Above

148. A product of the partial reduction of chlorine dioxide.
A. Chloride ion (Cl^-)
B. Chlorate ion ($ClO3^-$)
C. Chlorine dioxide (ClO2)
D. CxT value
E. None of the Above

149. The product of the net residual [concentration] of a disinfectant and [time], used as a measure of the amount of disinfection applied to a system.
A. Chloride ion (Cl^-)
B. Chlorate ion ($ClO3^-$)
C. Chlorine dioxide (ClO2)
D. CxT value
E. None of the Above

150. By-products of chlorination of water containing organics which are suspected carcinogens.
A. Chloride ion (Cl^-)
B. Chlorate ion ($ClO3^-$)
C. Chlorine dioxide (ClO2)
D. CxT value
E. None of the Above

151. By-products of chlorination of water containing organics which are suspected _____.
A. Stachybotrys
B. Sodium chlorate
C. Sodium chlorite
D. Carcinogens
E. None of the Above

152. The sodium salt of chloric acid; a precursor for chlorine dioxide production, especially for pulp bleaching.
A. Stachybotrys
B. Sodium chlorate
C. Sodium chlorite
D. Trihalomethanes
E. None of the Above

153. The sodium salt of chlorous acid, a precursor for chlorine dioxide production, especially for drinking water treatment.
A. Stachybotrys
B. Sodium chlorate
C. Sodium chlorite
D. Trihalomethanes
E. None of the Above

154. A particularly virulent type of toxic mold.
A. Stachybotrys
B. Sodium chlorate
C. Sodium chlorite
D. Trihalomethanes
E. None of the Above

155. Some people who use drinking water containing chlorine well in excess of EPA's standard could experience _____to their eyes and nose. Some people who drink water containing chlorine well in excess of the EPA's standard could experience stomach discomfort.
A. Stachybotrys
B. Sodium chlorate
C. Sodium chlorite
D. Trihalomethanes
E. None of the Above

156. Some people who use drinking water containing _____ well in excess of EPA's standard could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the EPA's standard could experience stomach discomfort or anemia.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

157. Some people who drink water containing _____ in excess of the EPA's standard over many years may experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

158. Some people who drink water containing _____in excess of the EPA's standard over many years may have an increased risk of getting cancer.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Haloacetic Acids
E. None of the Above

159. Some people who drink water containing _____ in excess of the EPA's standard over many years may have an increased risk of getting cancer.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

160. Some infants and young children who drink water containing _____ in excess of the EPA's standard could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorite in excess of the EPA's standard. Some people may experience anemia.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

161. In December 1998, the EPA established the Stage 1 Disinfectants/Disinfection Byproducts Rule that requires public water systems to use treatment measures to reduce the formation of _____and to meet the following specific standards.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

162. Some infants and young children who drink water containing _____in excess of the EPA's standard could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorine dioxide in excess of the EPA's standard. Some people may experience anemia.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

163. Disinfection byproducts form when disinfectants added to drinking water to kill germs react with naturally-occurring organic matter in water.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

164. _____are formed when disinfectants used in water treatment plants react with bromide and/or natural organic matter (i.e., decaying vegetation) present in the source water.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

165. _____produce different types or amounts of disinfection byproducts. Disinfection byproducts for which regulations have been established have been identified in drinking water, including trihalomethanes, haloacetic acids, bromate, and chlorite.
A. Bromate
B. Chlorite
C. Chlorine Dioxide
D. Disinfection Byproducts (DBPS)
E. None of the Above

166. _____are a group of four chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic and inorganic matter in water.
A. HAA5
B. Chloroform
C. THM
D. Chlorite
E. None of the Above

167. The trihalomethanes are _____, bromodichloromethane, dibromochloromethane, and bromoform.
A. HAA5
B. Chloroform
C. THM
D. Chlorite
E. None of the Above

168. _____are a group of chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic and inorganic matter in water.
A. HAA5
B. Chloroform
C. THM
D. Chlorite
E. None of the Above

169. The regulated haloacetic acids, known as _____, are: monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.
A. HAA5
B. Chloroform
C. THM
D. Chlorite
E. None of the Above

170. _____is a chemical that is formed when ozone used to disinfect drinking water reacts with naturally occurring bromide found in source water.
A. HAA5
B. Chloroform
C. THM
D. Bromate
E. None of the Above

171. _____ is a byproduct formed when chlorine dioxide is used to disinfect water.
A. HAA5
B. Chloroform
C. THM
D. Chlorite
E. None of the Above

172. EPA has published the **Stage 1 Disinfectants/Disinfection Byproducts Rule** to regulate chlorite at a monthly average level of _____ in drinking water.
A. Cryptosporidium
B. 1 PPM
C. Turbidity
D. SWTR
E. None of the Above

173. One of the key regulations developed and implemented by the United States Environmental Protection Agency (**USEPA**) to counter pathogens in drinking water is the _____.
A. Cryptosporidium
B. 1 PPM
C. Turbidity
D. SWTR
E. None of the Above

174. The _____specifies treatment criteria to assure that these performance requirements are met; they include turbidity limits, disinfectant residual, and disinfectant contact time conditions.
A. Cryptosporidium
B. 1 PPM
C. Turbidity
D. SWTR
E. None of the Above

175. The **Interim Enhanced Surface Water Treatment Rule** was established in December 1998 to control _____, and to maintain control of pathogens while systems lower disinfection byproduct levels to comply with the **Stage 1 Disinfectants/Disinfection Byproducts Rule**.
A. Cryptosporidium
B. 1 PPM
C. Turbidity
D. SWTR
E. None of the Above

176. The EPA established a _____ of zero for all public water systems and a 99% removal requirement for Cryptosporidium in filtered public water systems that serve at least 10,000 people.
A. Cryptosporidium
B. 1 PPM
C. Turbidity
D. MCLG
E. None of the Above

177. _____is an indicator of the physical removal of particulates, including pathogens.
A. Cryptosporidium
B. 1 PPM
C. Turbidity
D. SWTR
E. None of the Above

178. The EPA is also planning to develop other rules to further control _____.
A. Stage 1 Disinfectants/Disinfection Byproducts Rule
B. Cryptosporidium
C. Coliform bacteria
D. Fecal Coliform and E coli
E. None of the Above

179. The EPA has promulgating a Long Term 1 Enhanced Surface Water Treatment Rule, for systems serving fewer than 10,000 people. This is to improve physical removal of Cryptosporidium, and to maintain control of pathogens while systems comply with _____.
A. Stage 1 Disinfectants/Disinfection Byproducts Rule
B. Cryptosporidium
C. Coliform bacteria
D. Fecal Coliform and E coli
E. None of the Above

180. _____are common in the environment and are generally not harmful. However, the presence of these bacteria in drinking water is usually a result of a problem with the treatment system or the pipes which distribute water, and indicates that the water may be contaminated with germs that can cause disease.
A. Stage 1 Disinfectants/Disinfection Byproducts Rule
B. Cryptosporidium
C. Coliform bacteria
D. Fecal Coliform and E coli
E. None of the Above

181. _____are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms.
A. Stage 1 Disinfectants/Disinfection Byproducts Rule
B. Cryptosporidium
C. Fecal Coliform and E coli
D. None of the Above

182. _____ is a parasite that enters lakes and rivers through sewage and animal waste. It causes cryptosporidiosis, a mild gastrointestinal disease. However, the disease can be severe or fatal for people with severely weakened immune systems.
A. Stage 1 Disinfectants/Disinfection Byproducts Rule
B. Cryptosporidium
C. Coliform bacteria
D. Fecal Coliform and E coli
E. None of the Above

183. The EPA and CDC have prepared advice for those with severely compromised immune systems who are concerned about _____.
A. Stage 1 Disinfectants/Disinfection Byproducts Rule
B. Cryptosporidium
C. Coliform bacteria
D. Fecal Coliform and E coli
E. None of the Above

184. _____is a parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, and cramps).
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Elements
E. None of the Above

185. A broad group of bacteria including non-pathogens, pathogens, and opportunistic pathogens; they may be an indicator of poor general biological quality of drinking water. Often referred to as HPC?
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Elements
E. None of the Above

186. The halogens are a chemical series. They are the elements in Group 17 (old-style: VII or VIIA) of the periodic table: fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At) and the as yet undiscovered _____.
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Ununseptium
E. None of the Above

187. The periodic table is the single most unifying concept in chemistry. It is a structured listing of all known _____, or substances, that consist of one type of atom.
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Elements
E. None of the Above

188. _____ cannot be reduced to simpler substances.
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Elements
D. None of the Above

189. The term _____means "salt-former" and compounds containing halogens are called "salts".
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Elements
E. None of the Above

190. The word halogen was coined to mean _____ which produce salt in union with a metal. It comes from 18th c. scientific French nomenclature based on erring adaptations of Greek roots.
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Elements
E. None of the Above

191. _____ are highly reactive, and as such can be harmful or lethal to biological organisms in sufficient quantities.
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Elements
E. None of the Above

192. Chlorine and _____ are both used as disinfectants for such things as drinking water, swimming pools, fresh wounds, dishes, and surfaces.
A. Halogen(s)
B. Heterotrophic Plate Count Bacteria
C. Giardia lamblia
D. Iodine
E. None of the Above

193. They kill bacteria and other potentially harmful microorganisms, a process known as _____. Their reactive properties are also put to use in bleaching.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

194. _____ is the active ingredient of most fabric bleaches and is used in the production of most paper products.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

195. These elements are diatomic molecules in their natural form. They require one more electron to fill their outer electron shells, and so have a tendency to form a _____ negative ion.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

196. This negative ion is referred to as a halide ion; salts containing these ions are known as _____.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

197. _____combined with single hydrogen atoms form the hydrohalic acids (i.e., HF, HCl, HBr, HI), a series of particularly strong acids.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

198. _____with each other to form interhalogen compounds.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

199. _____ (BrF, ICl, ClF, etc.) bear strong superficial resemblance to the pure halogens.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

200. Many synthetic organic compounds such as plastic polymers, and a few natural ones, contain halogen atoms; these are known as halogenated compounds or organic _____.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

201. _____is by far the most abundant of the halogens, and the only one needed in relatively large amounts (as chloride ions) by humans.
A. Hydrohalic acids
B. Halides or Halide ions
C. Diatomic interhalogen compounds
D. Chlorine
E. None of the Above

202. _____ ions play a key role in brain function by mediating the action of the inhibitory transmitter GABA and are also used by the body to produce stomach acid.
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

203. _____is needed in trace amounts for the production of thyroid hormones such as thyroxine.
A. Fluorine
B. Bromine
C. Chloride
D. Iodine
E. None of the Above

204. Neither fluorine nor _____ are believed to be really essential for humans, although small amounts of fluoride can make tooth enamel resistant to decay.
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

205. All halogens have 7 electrons in their _____, giving them an oxidation number of -1.
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

206. This halogen exist, at room temperature, in this state of matter, solid form.
A. Fluoride
B. Bromine
C. Chlorine, Fluorine
D. Astatine, Iodine
E. None of the Above

207. This halogen exist, at room temperature, in this state of matter, liquid form.
A. Fluoride
B. Bromine
C. Chlorine, Fluorine
D. Astatine, Iodine
E. None of the Above

208. A measure of the acidity of water. The _____ scale runs from 0 to 14 with 7 being the mid point or neutral.
A. Logarithmic
B. pH
C. Acidity
D. Alkaline
E. None of the Above

209. A _____ of less than 7 is on the acid side of the scale with 0 as the point of greatest acid activity.
A. Logarithmic
B. pH
C. Acidity
D. Alkaline
E. None of the Above

210. A _____ of more than 7 is on the basic (alkaline) side of the scale with 14 as the point of greatest basic activity.
A. Logarithmic
B. pH
C. Acidity
D. Alkaline
E. None of the Above

211. The acidity of a water sample is measured on a pH scale. This scale ranges from **0** (maximum acidity) to **14** (maximum alkalinity). The middle of the scale, **7**, represents the neutral point. The acidity increases from _____ toward **0**.
A. Logarithmic
B. pH
C. Acidity
D. Neutral
E. None of the Above

212. Because the pH scale is logarithmic, a difference of one pH unit represents a tenfold change. For example, the _____ of a sample with a pH of **5** is ten times greater than that of a sample with a pH of **6**. A difference of 2 units, from **6** to **4**, would mean that the acidity is one hundred times greater, and so on.
A. Logarithmic
B. pH
C. Acidity
D. Alkaline
E. None of the Above

213. Normal rain has a_____of **5.6** – slightly acidic because of the carbon dioxide picked up in the earth's atmosphere by the rain.
A. Logarithmic
B. pH
C. Acidity
D. Alkaline
E. None of the Above

In this section you are to identify a specific halogen by the information that is provided.

214. **Boiling Point:** -188.14 °C (85.01 K, -306.652 °F)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

215. **Number of Protons/Electrons:** 9
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

216. **Number of Neutrons:** 10
A. Fluorine
B. Bromine
C. Chloride
D. None of the Above

217. **Crystal Structure:** Cubic **Density @ 293 K:** 1.696 g/cm^3 **Color:** Greenish
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

218. **Date of Discovery:** 1886 **Discoverer:** Joseph Henri Moissan
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

219. **Name Origin:** From the Latin word fluo (flow)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

220. **Melting Point:** -7.2 °C (265.95 K, 19.04 °F)
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

221. **Atomic Number:** 9
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

222. **Atomic Mass:** 18.998404 amu
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

223. **Melting Point:** -219.62 °C (53.530006 K, -363.31598 °F)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

224. **Boiling Point:** 58.78 °C (331.93 K, 137.804 °F)
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

225. **Boiling Point:** 184.0 °C (457.15 K, 363.2 °F)
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

226. **Number of Protons/Electrons:** 53
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

227. **Number of Neutrons:** 74
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

228. **Number of Protons/Electrons:** 35
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

229. **Color:** Red
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

230. **Date of Discovery:** 1826
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

231. **Discoverer:** Antoine J. Balard
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

232. **Atomic Number:** 85
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

233. **Atomic Mass:** (210.0) amu
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

234. **Name Origin:** From the Greek word brômos (stench)
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

235. **Uses:** Poisonous
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

236. **Obtained From:** Sea Water
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

237. **Atomic Number:** 53
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

238. **Atomic Mass:** 126.90447 amu
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

239. **Melting Point:** 113.5 °C (386.65 K, 236.3 °F)
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

240. **Number of Neutrons:** 45
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

241. **Density @ 293 K:** 3.119 g/cm^3
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

242. **Crystal Structure:** Orthorhombic **Density @ 293 K:** 4.93 g/cm^3 **Color:** Blackish
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

243. **Date of Discovery:** 1811
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

244. **Discoverer:** Bernard Courtois
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

245. **Name Origin:** From the Greek word iôdes (violet)
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

246. **Uses:** Required in humans
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

247. **Obtained From:** Sodium and potassium compounds
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

248. **Melting Point:** 302.0 °C (575.15 K, 575.6 °F)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

249. **Boiling Point:** 337.0 °C (610.15 K, 638.6 °F)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

250. **Number of Protons/Electrons:** 85
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

251. **Number of Neutrons:** 125
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

252. **Crystal Structure:** Unknown **Density @ 293 K:** Unknown
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

253. **Color:** Unknown
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

254. **Date of Discovery:** 1940
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

255. **Discoverer:** D.R. Corson
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

256. **Name Origin:** From the Greek word astatos (unstable)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

257. **Uses:** No uses known **Obtained From:** Man-made
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

258. **Atomic Number:** 17
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

259. **Atomic Mass:** 35.4527 amu
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

260. **Melting Point:** -100.98 °C (172.17 K, -149.764 °F)
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

261. **Boiling Point:** -34.6 °C (238.55 K, -30.279997 °F)
A. Fluorine
B. Bromine
C. Chloride
D. Chlorine
E. None of the Above

262. **Number of Protons/Electrons:** 17 **Number of Neutrons:** 18
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

263. **Crystal Structure:** Orthorhombic **Density @ 293 K:** 3.214 g/cm^3
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

264. **Color:** Green **Uses**: Water purification, bleaches
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

265. **Uses:** Refrigerants
A. Fluorine
B. Bromine
C. Chloride
D. Astatine
E. None of the Above

266. **Atomic Number:** 35
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

267. **Atomic Mass:** 79.904 amu
A. Fluorine
B. Bromine
C. Iodine
D. Astatine
E. None of the Above

268. **Obtained From**: Salt
A. Fluorine
B. Bromine
C. Chloride
D. Chlorine
E. None of the Above

269. **Date of Discovery:** 1774 **Discoverer:** Carl Wilhelm Scheele
A. Fluorine
B. Bromine
C. Chloride
D. Chlorine
E. None of the Above

270. **Name Origin:** From the Greek word khlôros (green)
A. Fluorine
B. Bromine
C. Chloride
D. Chlorine
E. None of the Above

Chlorine Gas Information and Identifiers
271. **TLV/IDLH**:
A. 1 ppm
B. 0.5ppm/15 minutes
C. 25 ppm
D. 3 ppm
E. 70.9

272. **NIOSH IDHL:**
A. 1 ppm
B. 0.5ppm/15 minutes
C. 25 ppm
D. 3 ppm
E. 70.9

273. **CAS No.:**
A. FO2100000
B. 7782-50-5
C. Poison gas
D. 1 ppm
E. 1017 20

274. **DOT UN:**
A. FO2100000
B. 7782-50-5
C. Poison gas
D. 1017 20
E. None of the Above

275. **DOT label:**
A. FO2100000
B. 7782-50-5
C. Poison gas
D. 1 ppm
E. 1017 20

276. **RTECS No.:**
A. FO2100000
B. 7782-50-5
C. Poison gas
D. 1 ppm
E. 1017 20

277. **TLV/TWA**:
A. FO2100000
B. 7782-50-5
C. Poison gas
D. 1 ppm
E. 1017 20

278. **TLV/STEL**:
A. 1 ppm
B. 0.5ppm/15 minutes
C. 25 ppm
D. 3 ppm
E. 70.9

279. **Vapor density**:
A. -101 degrees C (-149.8 degrees F)
B. -34.6 degrees C (-30.28 degrees F)
C. 1.41 at 20 degrees C (68 degrees F) and a pressure of 6.86 atm
D. 2.5
E. 4,800 mm Hg

280. **Melting point:**
A. -101 degrees C (-149.8 degrees F)
B. -34.6 degrees C (-30.28 degrees F)
C. 1.41 at 20 degrees C (68 degrees F) and a pressure of 6.86 atm
D. 2.5
E. None of the Above

281. **Vapor pressure at 20 degrees C (68 degrees F):**
A. -101 degrees C (-149.8 degrees F)
B. -34.6 degrees C (-30.28 degrees F)
C. 1.41 at 20 degrees C (68 degrees F) and a pressure of 6.86 atm
D. 2.5
E. 4,800 mm Hg

282. **NIOSH Ceiling**:
A. 1 ppm
B. 0.5ppm/15 minutes
C. 25 ppm
D. 3 ppm
E. 70.9

283. **PEL/TWA**:
A. 1 ppm
B. 0.5ppm/15 minutes
C. 25 ppm
D. 3 ppm
E. 70.9

284. **Molecular weight:**
A. 1 ppm
B. 0.5ppm/15 minutes
C. 25 ppm
D. 70.9
E. None of the Above

285. **Boiling point (at 760 mm Hg):**
A. -101 degrees C (-149.8 degrees F)
B. -34.6 degrees C (-30.28 degrees F)
C. 1.41 at 20 degrees C (68 degrees F) and a pressure of 6.86 atm
D. 2.5
E. 4,800 mm Hg

286. **Specific gravity (liquid):**
A. -101 degrees C (-149.8 degrees F)
B. -34.6 degrees C (-30.28 degrees F)
C. 1.41 at 20 degrees C (68 degrees F) and a pressure of 6.86 atm
D. 2.5
E. 4,800 mm Hg

287. Flammable gases and vapors form explosive mixtures with _____.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. Chlorine
E. Phosgene

288. Contact between _____ and many combustible substances (such as gasoline and petroleum products, hydrocarbons, turpentine, alcohols, acetylene, hydrogen, ammonia, and sulfur), reducing agents, and finely divided metals may cause fires and explosions.
A. Corrosive material
B. Amber liquid
C. Chlorine
D. None of the Above

289. Contact between _____ and arsenic, bismuth, boron, calcium, activated carbon, carbon disulfide, glycerol, hydrazine, iodine, methane, oxomonosilane, potassium, propylene, and silicon should be avoided.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. Chlorine
E. None of the Above

290. Chlorine is a greenish-yellow gas with a characteristic _____.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. None of the Above

291. It condenses to an _____at approximately -34 degrees C (-29.2 degrees F) or at high pressures.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. Chlorine
E. None of the Above

292. Odor thresholds ranging from 0.08 to part per million (ppm) parts of air have been reported. Prolonged exposures may result in _____.
A. Corrosive material
B. Amber liquid
C. Olfactory fatigue
D. Chlorine
E. None of the Above

293. Cylinders of chlorine may burst when exposed to elevated temperatures. Chlorine in solution forms a _____.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. Chlorine
E. None of the Above

294. Chlorine reacts with hydrogen sulfide and water to form hydrochloric acid, and it reacts with carbon monoxide and sulfur dioxide to form _____ and sulfuryl chloride. Chlorine is also incompatible with moisture, steam, and water.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. Phosgene
E. None of the Above

295. Containers of _____ may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool fire exposed containers from the sides with water until well after the fire is out.
A. Corrosive material
B. Amber liquid
C. Pungent odor
D. Chlorine
E. None of the Above

296. The American Conference of Governmental Industrial Hygienists (**ACGIH**) has assigned chlorine a _____of 0.5 ppm (1.5 mg/m(3)) as a TWA for a normal 8-hour workday and a 40-hour workweek and a short-term exposure limit (**STEL**) of 1.0 ppm (2.9 mg/m(3)) for periods not to exceed 15 minutes.
A. STEL
B. PEL
C. TLV
D. REL
E. None of the Above

297. Exposures at the _____ concentration should not be repeated more than four times a day and should be separated by intervals of at least 60 minutes [ACGIH 1994, p. 15].
A. STEL
B. PEL
C. TLV
D. REL
E. None of the Above

298. The current Occupational Safety and Health Administration (**OSHA**) _____ for chlorine is 1 ppm (3 milligrams per cubic meter (mg/m(3))) as a ceiling limit. A worker's exposure to chlorine shall at no time exceed this ceiling level [29 CFR 1910.1000, Table Z-1].
A. STEL
B. PEL
C. TLV
D. REL
E. None of the Above

299. It is important to understand the forms of chlorine which are present because each has a different disinfecting capability. The acid form, _____, is a much stronger disinfectant than the hypochlorite ion, OCL-.
A. Chlorination
B. HOCL
C. Disinfection
D. Disinfectant
E. None of the Above

300. The National Institute for Occupational Safety and Health (**NIOSH**) has established a _____for chlorine of 0.5 ppm mg/m(3)) as a TWA for up to a 10-hour workday and a 40-hour workweek and a short-term exposure limit (**STEL**) of 1 ppm (3 mg/m(3))[NIOSH 1992].
A. STEL
B. PEL
C. TLV
D. REL
E. None of the Above

301. In 1774, in his small experimental laboratory, Swedish pharmacist Carl Wilhem _____ released a few drops of hydrochloric acid onto a piece of manganese dioxide. Within seconds, a greenish-yellow gas arose.
A. Scheele
B. Davy
C. Smith
D. Randall
E. None of the Above

302. The fact that the greenish-yellow gas was actually an element was only recognized several decades later by English chemist Sir Humphrey _____. Until that time, people were convinced that the gas was a compound of oxygen.
A. Scheele
B. Davy
C. Smith
D. Randall
E. None of the Above

303. _____ gave the element its name on the basis of the Greek word khloros, for greenish-yellow. In 1810 he suggested the name "chloric gas" or "chlorine."
A. Scheele
B. Davy
C. Smith
D. Randall
E. None of the Above

304. When the first men to set foot on the moon returned to earth (Apollo 11 mission: 24.7.69) a _____was chosen as one of the disinfectants for destroying any possible moon germs.
A. Cl2
B. Soduim
C. Hypochlorite solution
D. Hypochlorous acid
E. None of the Above

305. When released to air, chlorine will react with water to form _____and hydrochloric acid, which are removed from the atmosphere by rainfall.
A. Ice
B. New life forms
C. Hypochlorite solution
D. Hypochlorous acid
E. None of the Above

306. Chlorine is slightly soluble in water. It reacts with water to form hypochlorous acid and hydrochloric acid. The hypochlorous acid breaks down rapidly. The _____also breaks down; its breakdown products will lower the pH of the water (makes it more acidic).
A. Basic
B. Aciditic
C. Hypochlorite solution
D. Hypochlorous acid
E. None of the Above

307. Because it is highly reactive, chlorine is usually found in nature bound with other _____ like sodium, potassium, and magnesium.
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

308. Chlorine is one of the most abundant chemical _____ on Earth. It is ubiquitous in soils, minerals, plants and animals. Seawater is a huge reservoir of dissolved chlorine weathered from the continents and transported to the oceans by Earth's rivers.
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

309. Chlorine is also one of the most useful chemical elements. Each chemical element has its own set of unique properties and chlorine is known as a very reactive element--so _____, in fact, that it is usually found combined with other elements in the form of compounds.
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

310. Chlorine is produced industrially from the compound sodium chloride, one of the many salts found in geologic deposits formed from the slow evaporation of ancient seawater. When electricity is applied to a brine solution of _____, chlorine gas (Cl_2), caustic soda (NaOH) and hydrogen gas (H_2) are generated according to the following reaction:
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

311. Chlorine gas cannot be produced without producing caustic soda, so chlorine and caustic soda are known as "_____," and their economics are inextricably linked.
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

312. Caustic soda, also called "_____," is used to produce a wide range of organic and inorganic chemicals and soaps. In addition, the pulp and paper, alumina and textiles industries use caustic soda in their manufacturing processes.
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

313. The "chlor-alkali" industry obtains two very useful chemicals by applying _____to sea salt.
A. Elements
B. Reactive
C. Sodium chloride
D. Co-products
E. None of the Above

314. Chlorine can be added as _____, calcium hypochlorite or chlorine gas. When any of these is added to water, chemical reactions occur.
A. Hypochlorous acid
B. Break down
C. Chlorine demand
D. Sodium hypochlorite
E. None of the Above

315. All three forms of chlorine produce _____when added to water.
A. Hypochlorous acid
B. Break down
C. Chlorine demand
D. Water temperature decreases
E. None of the Above

316. Hypochlorous acid is a weak acid but a strong disinfecting agent. The amount of hypochlorous acid depends on the pH and _____.
A. Hypochlorous acid
B. Break down
C. Chlorine demand
D. Water temperature
E. None of the Above

317. Under normal water conditions, hypochlorous acid will also chemically react and break down into a _____.
A. Hypochlorous acid
B. Break down
C. Chlorine demand
D. Hypochlorite ion
E. None of the Above

318. The _____is a much weaker disinfecting agent than hypochlorous acid, about 100 times less effective.
A. Hypochlorous acid
B. Break down
C. Chlorine demand
D. Hypochlorite ion
E. None of the Above

319. As the temperature is decreased, the ratio of _____increases. Temperature plays a small part in the acid ratio.
A. Hypochlorous acid
B. Break down
C. Chlorine demand
D. Water temperature decreases
E. Hypochlorite ion

320. The ratio of hypochlorous acid is greater at _____, pathogenic organisms are actually harder to kill. All other things being equal, higher water temperatures and a lower pH are more conducive to chlorine disinfection.
A. Hypochlorous acid
B. Lower temperatures
C. Chlorine demand
D. Water temperature increases
E. None of the Above

321. The effectiveness of chlorination depends on the _____of the water, the concentration of the chlorine solution added, the time that chlorine is in contact with the organism, and water quality.
A. Hypochlorous acid
B. Lower temperatures
C. Chlorine demand
D. Water temperature increases
E. None of the Above

322. As the concentration of the chlorine increases, the required _____to disinfect decreases.
A. Hypochlorous acid
B. Lower temperatures
C. Chlorine demand
D. Contact time
E. None of the Above

323. Chlorination is more effective as _____.
A. Hypochlorous acid
B. Lower temperatures
C. Chlorine demand
D. Water temperature increases
E. None of the Above

324. Chlorination is _____as the water's pH increases (becomes more alkaline).
A. Hypochlorous acid
B. Lower temperatures
C. Chlorine demand
D. Less effective
E. None of the Above

325. Chlorination is _____in cloudy (turbid) water.
A. Hypochlorous acid
B. Lower temperatures
C. Chlorine demand
D. Less effective
E. None of the Above

326. When _____ is added to the water supply, part of it combines with other chemicals in water (like iron, manganese, hydrogen sulfide, and ammonia) and is not available for disinfection.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Chlorine
E. None of the Above

327. The amount of chlorine that reacts with the other chemicals plus the amount required to achieve disinfection is the _____of the water.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Simple chlorination
E. None of the Above

328. The safest way to be sure that the amount of chlorine added is sufficient is to add a little more than is required. This will result in a _____residual that can be measured easily. This chlorine residual must be maintained for several minutes depending on chlorine level and water quality.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Free Chlorine
E. None of the Above

329. The Test kit should specify that it measures the free chlorine residual and not the _____.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Total Chlorine
E. None of the Above

330. Once _____ has combined with other chemicals it is not effective as a disinfectant. If a test kit does not distinguish between free chlorine and chlorine combined with other chemicals, the test may result in an overestimation of the chlorine residual.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Simple chlorination
E. None of the Above

331. Chlorine will kill bacteria in water, but it takes some time. The time needed depends on the concentration of chlorine. Two methods of chlorination are used to disinfect water: **simple chlorination** and _____.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Simple chlorination
E. None of the Above

332. _____involves maintaining a low level of free residual chlorine at a concentration of 0.30.5 mg/1 for at least 30 minutes. The residual is measured at the faucet most distant from the where chlorine is added to the water supply.
A. Superchlorination
B. Chlorination
C. Chlorine demand
D. Simple chlorination
E. None of the Above

333. To ensure the proper contact time of at least 30 minutes, a holding tank can be installed. Pressure tanks, while often thought to be sufficient, are usually too small to always provide 30 minutes of _____.
A. Contact Time
B. Chlorination
C. Chlorine demand
D. Simple chlorination
E. None of the Above

334. The measured amount of _____ in the water should be the same as the amount added. But water is not 100% pure. There are always other substances (interfering agents) such as iron, manganese, turbidity, etc., which will combine chemically with the chlorine.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

335. This is called the _____. Naturally, once chlorine molecules are combined with these interfering agents they are not capable of disinfection. It is free chlorine that is much more effective as a disinfecting agent.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

336. So let's look now at how free, total and combined chlorine are related. When a chlorine residual test is taken, either a total or a _____residual can be read.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

337. _____residual is a much stronger disinfecting agent. Therefore, most water regulating agencies will require that your daily chlorine residual readings be of free chlorine residual.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

338. Break-point chlorination is where the chlorine demand has been satisfied, any additional chlorine will be considered _____.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

339. Disinfection to eliminate fecal and coliform bacteria may not be sufficient to adequately reduce pathogens such as Giardia or viruses to desired levels. Use of the _____ disinfection concept is recommended to demonstrate satisfactory treatment, since monitoring for very low levels of pathogens in treated water is analytically very difficult.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. CT
E. None of the Above

340. The _____ concept, as developed by the United States Environmental Protection Agency (Federal Register, 40 CFR, Parts 141 and 142, June 29, 1989), uses the combination of disinfectant residual concentration (mg/L) and the effective disinfection contact time (in minutes) to measure effective pathogen reduction.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. CT
E. None of the Above

341. All surface water treatment systems shall ensure a minimum reduction in pathogen levels: _____in Giardia; and 4-log reduction in viruses. These requirements are based on unpolluted raw water sources with Giardia levels of = 1 cyst/100 L, and a finished water goal of 1 cyst/100,000 L (equivalent to 1 in 10,000 risk of infection per person per year).
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

342. Disinfection CT values shall be calculated daily using either the _____and the disinfectant residual at the same time, or by using the lowest CT value if it is calculated more frequently. Actual CT values are then compared to required CT values.
A. Chlorine
B. Chlorine demand
C. Free chlorine
D. Residual
E. None of the Above

343. _____has long been an accepted and effective part of many water treatment programs.
A. Enzymes
B. Oxidation chemistry
C. Oxidizing chemicals
D. Oxidant
E. None of the Above

344. _____used in today's water treatment programs include: chlorine, chlorine dioxide, bromine, bromine/chlorine releasing compounds, ozone and hydrogen peroxide.
A. Enzymes
B. Oxidation chemistry
C. Oxidizing chemicals
D. Oxidant
E. None of the Above

345. The primary killing mechanism these types of _____ use is oxidizing protein groups within a microorganism.
A. Enzymes
B. Oxidation chemistry
C. Oxidizing chemicals
D. Microbiocides
E. None of the Above

346. Proteins are the basic components of essential cellular _____ that are necessary for life-sustaining cellular processes such as respiration.
A. Enzymes
B. Oxidation chemistry
C. Oxidizing chemicals
D. Oxidant
E. None of the Above

347. The destruction of these proteins deprives the cell of its ability to carry out fundamental life functions and quickly kills it. One _____ is chlorine dioxide, which appears to provide an additional killing mechanism.
A. Enzymes
B. Oxidation chemistry
C. Oxidizing chemicals
D. Oxidant
E. None of the Above

348. Chlorine dioxide is able to diffuse readily through hydrophobic lipid layers of an organism, allowing it to react with _____, which directly inhibits protein synthesis.
A. Cellular amino acids
B. Oxidation chemistry
C. Oxidizing chemicals
D. Oxidant
E. None of the Above

349. Amino acids are the basic building blocks of all cellular proteins, destruction of these molecules has a _____on the microorganism.
A. Process-contaminated
B. Water solubility
C. Devastating effect
D. Extremely reactive
E. None of the Above

350. Chlorine gas is a pulmonary irritant with intermediate _____that causes acute damage in the upper and lower respiratory tract.
A. Process-contaminated
B. Water solubility
C. Devastating effect
D. Extremely reactive
E. None of the Above

351. Chlorine is _____with most elements. Because its density is greater than that of air, the gas settles low to the ground. It is a respiratory irritant, and it burns the skin. Just a few breaths of it are fatal.
A. Process-contaminated
B. Water solubility
C. Devastating effect
D. Extremely reactive
E. None of the Above

352. Chlorine gas is likely the most widely used _____.
A. Process-contaminated
B. Water solubility
C. Devastating effect
D. Oxidizing microbiocide
E. None of the Above

353. The combination of high chlorine demand in _____systems and the dissociation process in alkaline systems creates the need for greater chlorine feed to obtain the same microbial efficacy. This results in a higher concentration of HCl in the cooling system.
A. Process-contaminated
B. Water solubility
C. Devastating effect
D. Extremely reactive
E. None of the Above

354. Since HCl removes _____, pH depression and system corrosion could occur. In low pH water the passive, metal oxide layers protecting the metal may resolubulize, exposing the surface to corrosion.
A. Odor threshold
B. Alkalinity
C. Moderate water solubility
D. Negative impact
E. None of the Above

355. At free mineral acidity (pH <4.3), many passivating inhibitors become ineffective, and corrosion will proceed rapidly. Increased chloride may also have a _____on system corrosion. The chloride ion (Cl^-) can damage or penetrate the passive oxide layer, leading to localized damage of the metal surface.
A. Odor threshold
B. Alkalinity
C. Moderate water solubility
D. Negative impact
E. None of the Above

356. Exposure to chlorine gas may be prolonged because its moderate water solubility may not cause upper airway symptoms for several minutes. In addition, the _____is greater than that of air, causing it to remain near ground level and increasing exposure time.
A. Odor threshold
B. Alkalinity
C. Moderate water solubility
D. Negative impact
E. None of the Above

357. The _____for chlorine is approximately 0.3-0.5 parts per million (ppm); however, distinguishing toxic air levels from permissible air levels may be difficult until irritative symptoms are present.
A. Odor threshold
B. Alkalinity
C. Moderate water solubility
D. Negative impact
E. None of the Above

358. Cellular injury is believed to result from the oxidation of functional groups in cell components, from reactions with tissue water to form hypochlorous and hydrochloric acid, and from the generation of _____.
A. Odor threshold
B. Alkalinity
C. Moderate water solubility
D. Negative impact
E. None of the Above

359. Although the idea that chlorine causes _____by generating free oxygen radicals was once accepted, this idea is now controversial.
A. Odor threshold
B. Alkalinity
C. Moderate water solubility
D. Negative impact
E. None of the Above

360. The predominant targets of the acid are the _____ of the ocular conjunctivae and upper respiratory mucus membranes.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

361. Hypochlorous acid is also highly water soluble with an injury pattern similar to _____.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

362. Hypochlorous acid may account for the toxicity of elemental chlorine and _____to the human body.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

363. Chlorine gas, when mixed with ammonia, reacts to form chloramine gas. In the presence of water, chloramines decompose to ammonia and hypochlorous acid or _____.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

364. The early response to _____depends on the (1) concentration of chlorine gas, (2) duration of exposure, (3) water content of the tissues exposed, and (4) individual susceptibility.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

365. The immediate effects of chlorine gas toxicity include acute inflammation of the conjunctivae, nose, pharynx, larynx, trachea, and bronchi. Irritation of the airway mucosa leads to local edema secondary to active arterial and capillary hyperemia. _____results in filling the alveoli with edema fluid, resulting in pulmonary congestion.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

366. The hallmark of pulmonary injury associated with chlorine toxicity is pulmonary edema, manifested as _____. Noncardiogenic pulmonary edema is thought to occur when there is a loss of pulmonary capillary integrity.
A. Hydrochloric acid is highly soluble in water.
B. Hydrochloric acid
C. Epithelia
D. Chlorine exposure
E. None of the Above

367. Calcium or _____react explosively or form explosive compounds with many common substances such as ammonia, amines, charcoal, or organic sulfides
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

368. _____is a solution made from reacting chlorine with a sodium hydroxide solution. These two reactants are the major co-products from most chlor-alkali cells.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

369. Sodium hypochlorite has a variety of uses and is an excellent _____agent.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

370. Sodium hypochlorite also significantly increases the _____ of the water. When sodium hypochlorite is used, it must be counterbalanced by a strong acid like sodium bisulfate or muriatic acid to keep the pH within the ideal range.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

371. The _____of chlorine has been used since 1850. The most widely used form of hypochlorite is the liquid, sodium hypochlorite (NaOCl), with more than 150 tons per day consumed in the United States.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

372. Sodium hypochlorite application in cooling water is essentially the same as with gas chlorine; HOCl is produced as the active toxicant. The HOCl is equally susceptible to process contamination, has the same _____as gas chlorine and displays the same tendency.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

373. _____differs from chlorine gas in two respects: method of feed and hydrolization properties.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

374. Sodium hypochlorite can either be gravity-fed or applied with a metering pump. The latter is generally recognized as a consistently more accurate method. The second difference, in hydrolysis, lies in the end products. The NaOCl reaction with water liberates _____ (NaOH).
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

375. The addition of NaOH differs in that it tends to add alkalinity to the water. In large concentrations it may artificially elevate _____, leading to precipitation of calcium carbonate.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

376. While NaOCl eliminates low _____ corrosion as a concern, the use of large quantities in contaminated systems still introduces a high concentration of the chloride ion, which can be very aggressive to cooling system metals. Many of the other problems associated with chlorine remain present with sodium hypochlorite.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

377. Sodium hypochlorite has a long history. Around 1785 the Frenchman Berthollet developed liquid _____based on sodium hypochlorite.
A. Bleaching agents
B. Sodium hypochlorite
C. pH
D. Hypochlorite form
E. None of the Above

378. _____is a clear, slightly yellowish solution with a characteristic odor.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. None of the Above

379. _____has a relative density of is 1,1 (5,5% watery solution).
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

380. Sodium hypochlorite as a bleaching agent for domestic use it usually contains 5% sodium hypochlorite (with a _____ of around 11, it is irritating). If it is more concentrated, it contains a concentration 10-15% sodium hypochlorite (with a pH of around 13, it burns and is corrosive).
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

381. Sodium hypochlorite is _____.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

382. Chlorine evaporates at a rate of 0,75 gram active chlorine per day from the solution. Then heated sodium hypochlorite disintegrates. This also happens when sodium hypochlorite comes in contact with acids, sunlight, certain metals and poisonous and corrosive gasses, including chlorine gas.
_____is a strong oxidator and reacts with flammable compounds and reductors.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

383. Sodium hypochlorite solution is a _____that is inflammable. These characteristics must be kept in mind during transport, storage and use of sodium hypochlorite.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

384. Due to the presence of _____in sodium hypochlorite, the pH of the water is increased.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

385. When _____dissolves in water, two substances form, which play a role in for oxidation and disinfection.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda

386. These are hypochlorous acid (HOCl) and the less active _____
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

387. The _____ of the water determines how much hypochlorous acid is formed. While sodium hypochlorite is used, acetic acid (HCl) is used to lower the pH.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

388. Sulfuric acid (H2SO4) can be used as an alternative for acetic acid. Less harmful gasses are produced when _____is used. Sulfuric acid is a strong acid that strongly reacts with bases and that is very corrosive.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

389. Sodium hypochlorite can be produced by dissolving salt in softened water, which results in a concentrated brine solution. The solution is electrolyzed and forms a _____solution in water. This solution contains 150 g active chlorine (Cl2) per liter. During this reaction the explosive hydrogen gas is also formed.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

390. Sodium hypochlorite can be produced by adding chlorine gas (Cl2) to _____.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

391. Hypochlorite neutralizes sulphur hydrogen gas (SH) and ammonia (NH3). It is also used to _____in metal industries.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

392. Hypochlorite can be used to prevent algae and _____in cooling towers. In water treatment, hypochlorite is used to disinfect water. In households, hypochlorite is used frequently for the purification and disinfection of the house.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. None of the Above
E. All of the Above

393. _____is divided into hydrochloric acid (HCl) and oxygen (O). The oxygen atom is a very strong oxidator.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

394. _____is effective against bacteria, viruses and fungi. Sodium hypochlorite disinfects the same way as chlorine does.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

395. The advantage of the _____ is that no transport or storage of sodium hypochlorite is required. When sodium hypochlorite is stored for a long time, it becomes inactive.
A. pH
B. Sodium hypochlorite
C. Salt electrolysis system
D. Caustic soda
E. None of the Above

396. Another advantage of the on site process is that chlorine lowers the pH and no other acid is required to lower pH. The hydrogen gas that is produced is explosive and as a result ventilation is required for explosion prevention. This system is slow and a buffer of extra hypochlorous acid needs to be used.
A. Poisonous gasses
B. Hydrogen gas
C. Pathogenic microorganisms
D. None of the Above
E. All of the Above

397. When sodium hypochlorite is used, acetic or sulphuric acid are added to the water. An overdose can produce _____. If the dosage is too low, the pH becomes too high and can irritate the eyes.
A. Poisonous gasses
B. Hydrogen gas
C. Pathogenic microorganisms
D. None of the Above

398. Because sodium hypochlorite is used both to oxidize pollutions (urine, sweat, cosmetics) and to remove _____, the required concentration of sodium hypochlorite depends on the concentrations of these pollutions. Especially the amount of organic pollution determines the required concentration. If the water is filtered before sodium hypochlorite is applied, less sodium hypochlorite is needed.
A. Poisonous gasses
B. Hydrogen gas
C. Pathogenic microorganisms
D. None of the Above

399. _____ with chlorine is very popular in water and wastewater treatment because of its low cost, ability to form a residual, and its effectiveness at low concentrations.
A. Chlorination
B. HOCL
C. Disinfection
D. Disinfectant
E. None of the Above

400. Although it is used as a _____, it is a dangerous and potentially fatal chemical if used improperly. Despite the fact the disinfection process may seem simple, it is actually a quite complicated process.
A. Chlorination
B. HOCL
C. Disinfection
D. Disinfectant
E. None of the Above

401. _____ in wastewater treatment systems is a fairly complex science which requires knowledge of the plant's effluent characteristics. When free chlorine is added to the wastewater, it takes on various forms depending on the pH of the wastewater.
A. Chlorination
B. HOCL
C. Disinfection
D. Disinfectant
E. None of the Above

402. Ammonia present in the effluent can also cause problems as _____ are formed, which have very little disinfecting power.
A. Chlorination
B. HOCL
C. Disinfection
D. Disinfectant
E. None of the Above

403. Some methods to overcome the types of _____ formed are to adjust the pH of the wastewater prior to chlorination or to simply add a larger amount of chlorine.
A. Chlorine
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

404. An adjustment in the pH would allow the operators to form the most desired form of chlorine, _____, which has the greatest disinfecting power.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. NaOCl

405. Adding larger amounts of chlorine would be an excellent method to combat the chloramines because the ammonia present would bond to the chlorine but further addition of chlorine would stay in the _____or hypochlorite ion state.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

406. Chlorine gas, when exposed to water reacts readily to form _____, HOCl, and hydrochloric acid. $Cl_2 + H_2O$ -> HOCl + HCl
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

407. If the pH of the wastewater is greater than 8, the _____will dissociate to yield hypochlorite ion. HOCl <-> H^+ + OCl^-- If however, the pH is much less than 7, then HOCl will not dissociate.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

408. If _____ is present in the wastewater effluent, then the hypochlorus acid will react to form one three types of chloramines depending on the pH, temperature, and reaction time.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

409. _____ solutions degrade with Chlorate-forming reaction due to age, temperature, light and minor reduction in pH.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. NaOCl
E. None of the Above

410. _____ solutions degrade with Oxygen-producing reaction that occurs when metals, such as iron, copper or nickel, or metal oxides are brought into contact with the solution.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. NaOCl
E. None of the Above

411. NaOCl solutions degrade with _____-producing reaction when solution pH falls below 6.
A. Chlorination
B. Chlorine
C. Hypochlorus acid
D. Ammonia
E. None of the Above

412. Initial solution strength may affect the stability of a _____ solution.
A. NaOCl
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

413. pH solution may affect the stability of a _____ solution.
A. NaOCl
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

414. Temperature of the solution may affect the stability of a _____ solution.
A. NaOCl
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

415. Exposure of the solution to sunlight may affect the stability of a _____ solution.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

416. There is no threshold value for to sodium hypochlorite exposure. Various health effects occur after exposure to _____.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. NaOCl
E. None of the Above

417. People are exposed to sodium hypochlorite by inhalation of aerosols. This causes coughing and a sore throat. After swallowing _____the effects are stomach ache, a burning sensation, coughing, diarrhea, a sore throat and vomiting.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

418. _____on skin or eyes causes redness and pain. After prolonged exposure, the skin can become sensitive.
A. NaOCl
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

419. _____is poisonous for water organisms. It is mutagenic and very toxic when it comes in contact with ammonium salts.
A. Chlorination
B. Chlorine gas
C. THM
D. Ammonia
E. None of the Above

420. Hypochlorite solutions can liberate toxic gases such as _____. Chlorine's odor or irritant properties generally provide adequate warning of hazardous concentrations.
A. Chlorination
B. Chlorine
C. Hypochlorus acid
D. Ammonia
E. None of the Above

421. Prolonged, low-level exposures, such as those that occur in the workplace, can lead to olfactory fatigue and tolerance of _____ irritant effects.
A. Chlorination
B. Chlorine
C. Hypochlorus acid
D. Ammonia
E. None of the Above

422. _____ is heavier than air and may cause asphyxiation in poorly ventilated, enclosed, or low-lying areas.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

423. Direct contact with hypochlorite solutions, powder, or _____causes severe chemical burns, leading to cell death and ulceration. Because of their relatively larger surface area/weight ratio, children are more vulnerable to toxicants affecting the skin.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

424. Ingestion of hypochlorite solutions causes vomiting and corrosive injury to the gastrointestinal tract. Household bleaches (3 to 6% sodium hypochlorite) usually cause _____, but rarely cause strictures or serious injury such as perforation.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. None of the Above

425. Commercial bleaches may contain higher concentrations of _____and are more likely to cause serious injury.
A. NaOCl
B. Chlorine gas
C. Hypochlorus acid
D. Ammonia
E. None of the Above

426. _____is rare, but has been reported following the ingestion of household bleach. Pulmonary complications resulting from aspiration may also be seen after ingestion.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Calcium hypochlorite
E. None of the Above

427. Sodium and calcium hypochlorite are manufactured by the _____ of sodium hydroxide or lime.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Calcium hypochlorite
E. None of the Above

428. Sodium and _____are used primarily as oxidizing and bleaching agents or disinfectants. They are components of commercial bleaches, cleaning solutions, and disinfectants for drinking water and wastewater purification systems and swimming pools.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Calcium hypochlorite
E. None of the Above

429. It can easily and be stored and transported when it is produced on-site. Dosage is simple. Transport and storage of sodium hypochlorite are safe. Sodium hypochlorite is as effective as chlorine gas for disinfection. _____produces residual disinfectant.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Calcium hypochlorite
E. None of the Above

430._____is a dangerous and corrosive substance. While working with sodium hypochlorite, safety measures have to be taken to protect workers and the environment.
A. Chlorination
B. Chlorine gas
C. Hypochlorus acid
D. Calcium hypochlorite
E. None of the Above

Respiratory Protection Section

431. In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent _____.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

432. The above rule statement shall be accomplished as far as feasible by accepted engineering _____ (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials).
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

433 .When effective engineering controls are not feasible, or while they are being instituted, appropriate _____ shall be used pursuant to the RP Rule.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

434. Respirators shall be provided by the _____ when such equipment is necessary to protect the health of the employee.
A. Employer
B. Employee
C. Atmospheric contamination
D. None of the Above

435. The _____ shall provide the respirators which are applicable and suitable for the purpose intended.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

436. Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes _____by passing ambient air through the air-purifying element.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

437. Atmosphere-supplying _____ means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

438. Canister or cartridge means a container with _____, or combination of these items, which removes specific contaminants from the air passed through the container.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

439. Demand _____ means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

440. _____means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

441. _____exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

442. End-of-service-life indicator (ESLI) means a system that warns the _____ user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.
A. Employer
B. Employee
C. Atmospheric contamination
D. Respirator
E. None of the Above

443. _____means a respirator intended to be used only for emergency exit.
A. Fit factor
B. Escape-only respirator
C. Filter or air purifying element
D. Helmet
E. None of the Above

444. _____means a component used in respirators to remove solid or liquid aerosols from the inspired air.
A. Fit factor
B. Escape-only respirator
C. Filter or air purifying element
D. Helmet
E. None of the Above

445. Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the _____ or with the entire facepiece composed of the filtering medium.
A. Fit factor
B. Escape-only respirator
C. Filter or air purifying element
D. Facepiece
E. None of the Above

446. _____means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.
A. Fit factor
B. Escape-only respirator
C. Filter or air purifying element
D. Helmet
E. None of the Above

447. _____means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.
A. Fit factor
B. Escape-only respirator
C. Filter or air purifying element
D. Fit test
E. None of the Above

448. _____ means a rigid respiratory inlet covering that also provides head protection against impact and penetration.
A. Fit factor
B. Escape-only respirator
C. Filter or air purifying element
D. Helmet
E. None of the Above

449. _____means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter.
A. Fit factor
B. Escape-only respirator
C. High efficiency particulate air (HEPA) filter
D. Helmet
E. None of the Above

450. Hood means a respiratory inlet covering that completely covers the _____and may also cover portions of the shoulders and torso.
A. Facepiece
B. Head and neck
C. Dangerous atmosphere
D. Oxygen
E. None of the Above

451. Immediately dangerous to life or health (IDLH) means an _____ that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.
A. Facepiece
B. Head and neck
C. Atmosphere
D. Oxygen
E. None of the Above

452. Interior structural firefighting means the physical activity of _____, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage.
A. Fire suppression
B. Head and neck
C. Dangerous atmosphere
D. Oxygen
E. None of the Above

453. Loose-fitting _____ means a respiratory inlet covering that is designed to form a partial seal with the face.
A. Facepiece
B. Head and neck
C. Dangerous atmosphere
D. Respirator
E. None of the Above

454. Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the_____ outside the respirator.
A. Facepiece
B. Head and neck
C. Ambient air pressure
D. Oxygen
E. None of the Above

455. Oxygen deficient atmosphere means an atmosphere with an _____ content below 19.5% by volume.
A. Facepiece
B. Head and neck
C. Dangerous atmosphere
D. Oxygen
E. None of the Above

456. Physician or other _____ means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. None of the Above

457. Positive pressure respirator means a respirator in which the pressure inside the _____ inlet covering exceeds the ambient air pressure outside the respirator.
A. Qualitative fit test
B. Respiratory
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

458. Powered air-purifying respirator (PAPR) means an _____ respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Air-purifying
E. None of the Above

459. Pressure demand _____ means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

460. _____ means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

461. _____ means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

462. Respiratory inlet covering means that portion of a _____ that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

463. _____ means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

464. Service life means the period of time that a _____, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

465. Supplied-air respirator (SAR) or airline _____means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.
A. Qualitative fit test
B. Respirator
C. Licensed health care professional
D. Self-contained breathing apparatus
E. None of the Above

466. Tight-fitting _____ means a respiratory inlet covering that forms a complete seal with the face.
A. Facepiece
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

467. User _____ means an action conducted by the respirator user to determine if the respirator is properly seated to the face.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

468. In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written _____with worksite-specific procedures.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

469. The _____shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

470. Your employer shall include in the program, procedures for selecting _____for use in the workplace.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

471. Your employer shall include in the program, medical evaluations of _____ required to use respirators.
A. RP program
B. Seal check
C. Respirator(s)
D. Employees
E. None of the Above

472. Your employer shall include in the program, fit testing procedures for tight-fitting _____.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

473. Your employer shall include in the program, procedures for proper use of _____ in routine and reasonably foreseeable emergency situations.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

474. Your _____ shall include in the program, procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

475. Your employer shall include in the program, procedures to ensure adequate air quality, quantity, and flow of breathing air for _____.
A. RP program
B. Seal check
C. Respirator(s)
D. Atmosphere-supplying respirators
E. None of the Above

476. Your _____ shall include in the program, training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

477. Your employer shall include in the program, training of employees in the proper use of _____, including putting on and removing them, any limitations on their use, and their maintenance.
A. RP program
B. Seal check
C. Respirator(s)
D. Employer
E. None of the Above

478. An employer may provide respirators at the request of _____or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard.
A. RP program
B. Seal check
C. Respirator(s)
D. Employees
E. None of the Above

479. The _____ must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

480. Exception: _____ are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

481. The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of _____.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

482. The employer shall provide respirators, training, and medical evaluations at no cost to the _____.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employee
E. None of the Above

483. Selection of respirators. Requires the _____ to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

484. The _____ shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

485. The _____ shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

486. The _____ shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

487. Where the employer cannot identify or reasonably estimate the employee exposure, the _____ shall consider the atmosphere to be IDLH.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

488. The employer shall select respirators from a sufficient number of _____ models and sizes so that the respirator is acceptable to, and correctly fits, the user.
A. Program effectiveness
B. Health hazard
C. Respirator(s)
D. Employer
E. None of the Above

489. Respirators for IDLH atmospheres. The _____ shall provide the following respirators for employee use in IDLH atmospheres:
A. Program effectiveness
B. Health hazard chart
C. Respirator(s)
D. Employer
E. None of the Above

490. A _____certified by NIOSH for a minimum service life of thirty minutes.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator
D. Employer
E. None of the Above

491. Respirators provided only for escape from _____shall be NIOSH-certified for escape from the atmosphere in which they will be used.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. LEL
E. None of the Above

492. All oxygen-deficient atmospheres shall be considered _____. Exception: If the employer demonstrates that, under all foreseeable conditions.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. LEL
E. None of the Above

493. Respirators for atmospheres that are _____. The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. Not IDLH
E. None of the Above

494. The _____ selected shall be appropriate for the chemical state and physical form of the contaminant.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. Employer
E. None of the Above

495. For protection against gases and vapors, your employer shall provide an atmosphere-supplying _____.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. Employer
E. None of the Above

496. For protection against gases and vapors, your _____ shall provide an air-purifying respirator, provided that the respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. Employer
E. None of the Above

497. If there is no ESLI appropriate for conditions in the employer's workplace, the _____ implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life.
A. full facepiece pressure demand SCBA
B. IDLH atmospheres
C. Respirator(s)
D. Employer
E. None of the Above

498. The employer shall describe in the respirator program the information and data relied upon and the basis for the _____change schedule and the basis for reliance on the data.
A. Canister and cartridge
B. Particulates
C. Air-purifying respirator
D. Aerodynamic diameters
E. None of the Above

499. For protection against _____, the employer shall provide an atmosphere-supplying respirator.
A. Canister and cartridge
B. Particulates
C. Air-purifying respirator
D. Aerodynamic diameters
E. None of the Above

500. For protection against _____, the employer shall provide an air-purifying respirator equipped with a filter certified by NIOSH.
A. Canister and cartridge
B. Particulates
C. Air-purifying respirator
D. Aerodynamic diameters
E. None of the Above

You are finished with your assignment; please complete the Registration page and the Customer Survey sheet. You can fax this information to us.

"For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life. For God did not send his Son into the world to condemn the world, but to save the world through him.

Please fax the answer key to
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Call us a couple hours after faxing to ensure that we received your paperwork.

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Thank you…